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Editorial

Election results are in and congratulations are in order for Bob Bateman, our new president-elect, and for Ham Benghuzzi, our new director. The president-elect is responsible for organizing and arranging for the Dodgen lecture (keynote speaker) at the annual meeting two years hence. The president-elect automatically becomes president on his second year in office and presides over the annual meeting. The following year the president becomes immediate past president whose experience is valuable to the current president and president-elect.

We have three members on the board of directors that share the title of director. They each serve three-year terms with one rotating off and one newly elected each year. These directors, along the president-elect, president, immediate past president, executive officer, and journal editor comprise the board of directors for the academy. Certain constitutional issues, such as establishing dues, are controlled by a vote of the board of directors. Broader issues are decided by a vote of the board of directors and the division chairs.

This journal issue contains the first call for abstracts for the annual meeting. The meeting will be held in Biloxi, MS, on 21 & 22 February 2002. And as you think about the research that you intend to present at the annual meeting, keep in mind that this journal is an appropriate outlet for some of the research that is presented at our annual meeting. Research that is of local nature or limited scope is appropriate for our state science academy journal, but might not be appropriate for national publication. If your research involves the efforts of graduate students, you can provide benefits to them beyond the experience of presenting at the annual meeting. The Journal of the Mississippi Academy of Sciences is peer reviewed and can serve as a first experience in peer reviewed publishing for the young scientists in your laboratory as well as for your own regional or small-scale research projects.—Ken Curry

[insert Ohause advertisment here.]

The Mississippi Academy of Sciences has a new address:

Mississippi Academy of Sciences
Post Office Box 55907
Jackson, MS 39296-5907

Publications of the State Academies of Science

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Since their origin, state academies of science have promoted and disseminated regional scientific research through the publication of journals and conference proceedings. For the most part, these multi-disciplinary publications have been overshadowed by the more voluminous, specialized publications of the larger scientific societies and publishers. Nevertheless, an examination of the titles currently published by the state academies of science indicates that on the basis of content, subscription levels, library ownership rates, indexing/abstracting practices and professional citation levels it can be concluded that the publications of the state academies of science remain an important means for the distribution of scientific research. Keywords: Periodicals, Scientific and Technical, Scientific and Technical Literature, Serial Publications, State Academies of Science, Professional Societies.

Although greatly overshadowed by the larger national and international professional societies, state academies of science play an important role in scientific research and education in the United States. Originally established to improve local and regional scientific communication and research, state academies of science now contribute to science education by sponsoring junior academies and science fairs as well as providing a forum for graduate students and other young researchers to make their initial research presentations at the academies' annual meetings. In addition, most academies contribute to the body of scientific literature by publishing members' research in conference proceedings and/or journals.

Just as the state academies are now overshadowed by the larger more prestigious professional societies, the publications of the state academies of science are overshadowed by the more voluminous, more prestigious specialized scientific journals published by the large societies and for-profit science publishers. Consequently, the question arises "how relevant are the publications of the state academies of science?" This is not a new question; J. McKeen Cattell argued almost 100 years ago that "there is no excuse for presenting researches on utterly diverse subjects in one volume because the authors happen to be members of the same academy" (1902). State academies of science have ignored such pronouncements and have continued actively publishing refereed journals and conference proceedings containing research from all areas of science.

HISTORY

With the exception of reports within academy publications themselves, coverage of the historical development of the state academies of science has been limited. However, two writers Bevan (1951) and Midgette (1991) provide interesting accounts of the history of the state academies. In "Science on the March: A Modern State Academy of Science," Arthur Bevan details the early history of scientific professional societies in general and state academies of science in particular. More recently in *To Foster the Spirit of Professionalism: Southern Scientists and State Academies of Science*, Nancy Smith Midgette provides an exhaustive historical account of the growth of the state academies of science in the South from the early days in the 1890's to the present day Southern academies.

While the first state academies of science were founded in the late 1700's in Maryland (1797) and Connecticut (1799), most state academies of science began in the late 1800's or early 1900's. Since at that time most of the scientific research and advanced

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education in the United States occurred in the Northeast, it was there that professional societies were initially organized and meetings were convened. Due to limits in communication and transportation, scientists in the South, Midwest, and West were isolated from much of the national professional activities located in the Northeast. As a result, local and state academies of science played an essential role in the development of regional scientific research and education. The original objectives of the state academies of science were to cultivate a general interest in natural history and other scientific subjects, to encourage individuals to work and publish in the sciences, to increase the knowledge about each state and its resources and to collect specimens.

For the early state academies of science, the major event was an annual meeting where state scientists gathered for the presentation of papers. At that time, presenters generally appeared before the entire group of conference attendees at a large assembly hall. As transportation and communication improved and scientific research became more specialized, the need for state academies of science to serve in their original role decreased. However, as the scientific community changed so did the academies. By the 1940's most academies had created sectional subdivisions to make the meetings more interesting to attendees. Often only the opening speech by a well-known keynote speaker or a topical symposium on state issues was attended by all conference attendees. To attract new members, some academies broadened their scope to include researchers in the social sciences. Other academies created junior academies of science and promoted science fairs and science education.

Today, state academies of science focus much of their attention on promoting science and science education on the state and local level. The annual meetings of the state academies of science provide a forum for young researchers, such as graduate students, to present their first papers. Abstracts of these papers are often recorded in the publications of the state academies of science.

RESEARCH INTO THE PUBLICATIONS OF THE STATE ACADEMIES OF SCIENCE

To date, there has been little research into to the publications of the state academies of science. The most detailed analysis of the academies' publications is in the work of Harry R. Skallerup, published over 40 years ago. In a column in *Science* (1955) and a University of Illinois Library School Occasional Paper (1957), Skallerup provides a detailed evaluation of the 36 state academies of science publications that existed in the 1950's. Skallerup's study examines the publications' content and subject focus, the extent of indexing, and the number of owning libraries.

Similar to Skallerup's study in the 1950's, the intent of this study is to report on the publications of state academies of science as they exist in the 1990's. To this end, state academies of science titles have been identified by consulting *Ulrich's International Periodical Directory*, the "Journals Indexed" list for State Academies of Science Abstracts and the OCLC bibliographic database. Additional information on each title has been gathered by sending a questionnaire to each of the titles' editors, consulting "titles indexed" lists for indexing/abstracting publications, performing title searches in many of the major science databases (e.g., Agricola, BIOSIS, Cab Abstracts, Chemical Abstracts, Compendex, Georef, Inspec, Medline and Zoological Record) and searching State Academies of Science Abstracts for subject content. All of this information has been entered into a Visual dBase database. A summary of our findings follow.

TITLES PUBLISHED BY THE STATE ACADEMIES OF SCIENCE

For our study, we have identified 45 serial titles that are currently being published by one of the state academies of science:

Annals of the New York Academy of Sciences
Bulletin—Southern California Academy of Sciences
Bulletin of the New Jersey Academy of Science
Bulletin of the South Carolina Academy of Science
California Wild
Encyclia (Utah)
Florida Scientist
Georgia Journal of Science
Intermountain Journal of Sciences (Montana)
Journal of the Alabama Academy of Science
Journal of the Arizona-Nevada Academy of Science
Journal of the Colorado-Wyoming Academy of Science
Journal of the Elisha Mitchell Scientific Society (North Carolina)
Journal of the Idaho Academy of Science

Journal of the Iowa Academy of Science
Journal of the Kentucky Academy of Science
Journal of the Minnesota Academy of Science
Journal of the Mississippi Academy of Sciences
Journal of the Pennsylvania Academy of Science
Journal of the Tennessee Academy of Science
Journal of the Washington Academy of Science (District of Columbia)
Michigan Academician
New Mexico Journal of Science
Ohio Journal of Science
Proceedings of the Arkansas Academy of Science
Proceedings of the California Academy of Sciences
Proceedings of the Indiana Academy of Science
Proceedings of the Louisiana Academy of Sciences
Proceedings of the Nebraska Academy of Sciences
Proceedings of the North Dakota Academy of Science
Proceedings of the Oklahoma Academy of Science
Proceedings of the Oregon Academy of Science
Proceedings of the South Dakota Academy of Science
Proceedings of the West Virginia Academy of Science
Sciences, The (New York)
Texas Journal of Science
Transactions of the Delaware Academy of Science
Transactions of the Illinois State Academy of Science
Transactions of the Kansas Academy of Science
Transactions of the Missouri Academy of Science
Transactions of the Nebraska Academy of Sciences
Transactions of the New York Academy of Sciences
Transactions of the Wisconsin Academy of Sciences, Arts and Letters
Virginia Journal of Science
Wisconsin Academy Review

In addition to these proceedings and journals, several state academies publish occasional papers (usually monographic in nature) under individual titles. Examples of these publications include *Monograph of the Montana Academy of Sciences*, *Occasional Paper of the Missouri Academy of Science*, *Occasional Papers of the California Academy of Sciences* and *Occasional Paper of the Vermont Academy of Arts and Sciences*. Other publications of the state academies include newsletters and bulletins, membership directories, annual reports, field trip reports, junior academy of science newsletters and meeting reports and state science fair bulletins.

PUBLICATION INFORMATION

The serial titles of the state academies of science are a diverse group (see appendix 1 for data on specific titles). However, in general, state academies produce inexpensive, peer-reviewed publications with limited circulation. The frequency of publication varies, with 17 titles being published 4 to 6 times per year, 8 being published 2 to 3 times per year, 14 being published annually and 8 being published at semi-annual or irregular intervals.

Subscribers are primarily members (who receive subscriptions with their membership) and local, state and regional libraries. Of the 45 titles examined, only two of the more popular-oriented magazines have a large readership. *The Sciences*, published by the New York Academy of Sciences, has a circulation of 75,000 and *California Wild*, published by the California Academy of Science, has a circulation of 30,000. The remaining 43 titles have an average circulation of under 770, yielding a combined subscription base of just over 33,000.

Libraries are important subscribers to state academies of science publications as they greatly increase the readership of the publications beyond that of the academies' members. OCLC member institutions account for over 8300 past and present subscriptions. Since state academies of science publications often focus on science research of state and regional interest, library ownership of most titles is greatest in each academy's state and region. Not surprisingly, state academies of science publications from large, heavily-populated states (e.g., New York) and regions (e.g., the Midwest) have the greatest library ownership. Overall, the median number of libraries owning a particular state academy of science publication is 137.

Despite the limited number of subscribers, the subscription price of most state academies of science titles is very low. The median price is $25.00, as all but four of the titles have subscription prices of less than $100. Only the voluminous *Annals of the New York Academy of Sciences* with an annual standing-order price of over $3500 can be considered expensive.

The costs of publication are kept low in part by limiting the number of pages printed. By science serials standards, state academies of science publications are small. Issues for most titles are under 100 pages with the median size being 50 pages. Many state academies also keep their costs low by relying on authors to help defray publishing costs. This is generally done by assessing page charges; these charges range anywhere from $10 to $105 per page.

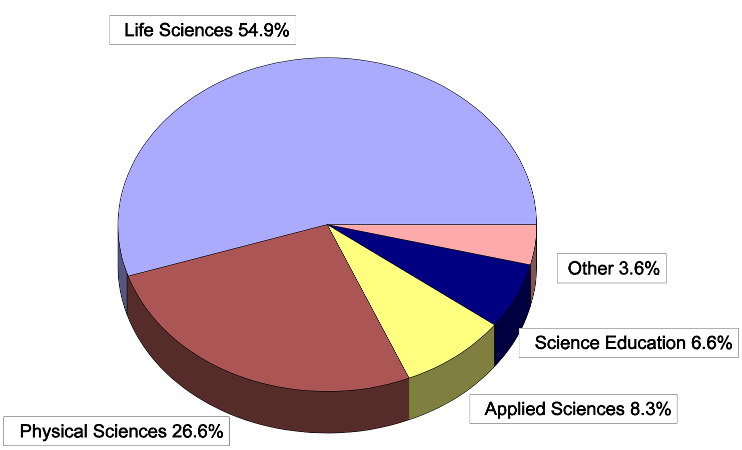
Perhaps due to budget limitations, state academies of science have been relatively slow to make the transition from print to electronic publications. Currently, the full-text articles are available (free-of-charge) via the Internet for three state publications, *California Wild*, *Journal of the Mississippi Academy of Sciences* and *Transactions of the Kansas Academy of Science*. Three additional titles, *Journal of the Idaho Academy of Science*, *Journal of the Iowa Academy of Science* and *Michigan Academician,* are expected to have articles available online in 1999. Other academies either currently make available or have immediate plans to make available abstracts, table of contents or indexes at the state academies' web sites. (A list of Internet addresses can be found in appendix 2).

CONTENT OF COVERAGE

The publications of the state academies of science are generally peer-reviewed and multi-disciplinary in nature, with a strong emphasis on regional plant and animal studies. A few of the titles have a particularly strong interest in environmental, agricultural, geological or water research. While a couple of titles (e.g., *Annals of the New York Academy of Sciences* and *New Mexico Journal of Science*) publish volumes dedicated to a single subject, most publish multi-disciplinary issues with no particular theme.

An examination of 2097 articles and abstracts published in 40 state academies of science titles during 1997 (and indexed in State Academies of Science Abstracts) demonstrates the biological science focus of state academies of science research (see Figure 1). Of the 2097 titles, 1151 of the publications deal with topics in the life sciences (e.g., agriculture, botany, microbiology, physiology and zoology); 557 focus on areas in the physical sciences (e.g., chemistry, geology and physics); 174 cover the applied sciences (e.g., math, computer science and engineering); 139 deal with topics in science education; 59 deal with social science topics (e.g., anthropology, psychology and sociology) and 17 deal with humanities topics (e.g., history and literature).

Figure 1: Subject Content of 1997 Articles



INDEXING

Since the circulation of most of the titles is relatively small and since browsing by researchers at owning libraries is probably limited due to the multidisciplinary nature of the publications, indexing plays a particularly important role in insuring that authors publishing their research in the academies' publications are able to reach others in the scientific community.

Indexing of the publications of the state academies of science varies greatly among the titles; some titles (e.g., *Annals of the New York Academy of Sciences*, *Ohio Journal of Science* and *Texas Journal of Science*) are well indexed, but others (e.g., *Intermountain Journal of the Sciences*, *Proceedings of the Nebraska Academy of Sciences*, *Transactions of the Delaware Academy of Science* and *Wisconsin Academy Review*) appear to receive little indexing. Overall, the publications of state academies of science are indexed by more than 101 different indexing and abstracting sources. The average number of indexes per title is 11 (see appendix 1 for data on specific titles). Perhaps, more important than the number of indexes, is the fact that many of the publications are indexed by the major scientific indexing and abstracting sources (see Table 1).

Just as indexing varies among the titles, indexing also varies among scientific disciplines. The state academies of science publications are well indexed (approximately three fourths of the titles) in the areas of zoology, geology and the aquatic sciences. Over half of the titles are indexed in chemistry (although relatively few citations actually make it into *Chemical Abstracts*). Approximately a third of the titles are indexed in the general biology (i.e., Biological Abstracts) and agricultural indexes. Less than ten percent of the titles are indexed in the areas of mathematics, physics, computer science and engineering.

Table 1. Indexing and Abstracting Sources.

Title	Number of SAS Titles
State Academies of Science Abstracts	40
GeoRef	34
Zoological Record	34
Chemical Abstracts	25
BIOSIS	19
CAB Abstracts	16
Selected Water Resources Abstracts	15
Agricola	4
Science Citation Index	4
Zentralblatt fur Mathematik	4
Inspec	3
ISTP: Index to Scientific & Technical Proceedings	2
Mathematical Reviews	2
Compendex	1
Medline	1
Wilson Indexes	1

In addition to the lack of indexing for some titles and the lack of indexing in some subject areas there is the problem of selective indexing. Since the publications are multi-disciplinary in nature, a selective approach by the specialized indexes is reasonable. However, this lack of comprehensive indexing may cause some articles to be well indexed and others to be poorly indexed. A recognition of this problem led to the creation of a relatively new index in 1995.

The index, *State Academies of Science Abstracts* produced by AcadSci Incorporated, was initially issued on CD-ROM. Since 1997, an Internet version of the database has been available at http://www.acadsci.com/. The database is unique as it provides complete indexing of all full-length papers and proceedings abstracts published in 40 state academies of science publications.

Since the inception of *State Academies of Science Abstracts*, AcadSci has worked closely with the different academies to increase the accessibility of the publications of the state academies of science. In addition to providing complete, comprehensive indexing of 40 state academy titles, the database continues to add the back files for many of the titles. While coverage of most titles begins in 1985, coverage of titles published by some academies (e.g., Illinois, Ohio, Pennsylvania, Virginia and West Virginia) goes back more than fifty years. Consequently, access to state academy research continues to improve.

CITATIONS AND IMPACT FACTORS

The level of indexing is important as it increases the degree to which the information is accessible to future researchers. The more widely an article is indexed, the more likely it will be read. Perhaps a more significant indicator of the importance of a particular piece of published research is not the degree that it is read but the degree that it is used in other research. This is best demonstrated by how often a work is cited. The primary record of scientific citation levels is *Science Citation Index*, published by the Institute of Scientific Information (ISI).

In addition to publishing the *Science Citation Index,* ISI publishes an annual *Journal Citation Reports* (*JCR*) that tabulates information from the past two years' *Science Citation Index*. Included for each of the more than 4500 journals covered by *Journal Citation Reports* is the number of articles published, number of citations, impact factor, immediacy index and cited half-life.

Of the measures published in *Journal Citation Reports*, the most commonly examined in journal evaluation is the journal impact factor. ISI calculates the impact factor by "dividing the number of current citations to articles published in the two previous years by the total number of articles published in those two years" (Impact, 1998).

Unfortunately, *Science Citation Index* indexes only four of the state academies of science titles (*Annals of the New York Academy of Sciences*, *Ohio Journal of Science*, *Sciences* and *Texas Journal of Science*). Since ISI includes in the *JCR* only those titles it indexes, there are no available impact factors for the remainder of the state academies of science titles. As shown in Table 2, an examination of the 1994–1996 *Journal Citation Reports* demonstrates that *Annals of the New York Academy of Sciences* has by far the greatest impact factor and level of citations. The other three titles have relatively low impact factors with their impact factors causing them to be ranked in or near the bottom 10% of all journals covered in the JCR and in the bottom 25% of multi-disciplinary science titles.

All four of the titles have lengthy cited half-lives. The cited half-life for a journal is "the number of publication years from the current year which account for 50% of current citations a journal received" (Cited, 1998). *Annals of the New York Academy of Sciences* has a cited half-life of greater than 7.5 years; *Ohio Journal of Science*, *Sciences* and *Texas Journal of Science* all have cited half-lives of greater than 10 years. These high cited half-lives are to be expected due the significant amount of plant, animal and earth science studies published in the titles.

Although no citation information is available for the other state academies of science publications, it seems reasonable to assume that they have similarly low levels of citations and impact factors and high cited half-life figures.

CONCLUSION

Today, state academies of science continue to play a valuable role in science education. Through junior academies and science fairs, young people are encouraged to become involved in the sciences. Through state meetings, the academies provide a means for young scientists to present their research. The publications of the state academies of science chronicle this research. While the publications of the state academies of science are generally not considered part of the core literature of the sciences, they are an important source of state and regional scientific research.

From our examination of the publications of the state academies of science, it is clear that they represent a relatively diverse literature. However in general, they are inexpensive, peer-reviewed publications with limited readerships and limited impact (based on citation levels). While the titles are multidisciplinary, there is preponderance of articles in the life and earth sciences. Indexing varies among titles and even articles within titles but overall it is adequate (particularly with the availability of State Academies of Science Abstracts). Although many are considered minor works, the publications of the state academies of science offer researchers and librarians inexpensive access to state and regional scientific research, and consequently serve as a valuable resource for science and technology libraries.

Table 2. Impact Factors and Citations.

Title	1994 Impact	1995 Impact	1996 Impact	Average Impact	Avg. # of Citations
Annals of the NYAS	0.868	0.868	1.030	0.922	21414
Ohio Journal of Science	0.135	0.080	0.109	0.108	198
Texas Journal of Science	0.080	0.073	0.133	0.095	130
Sciences	0.011	0.011	0.000	0.007	243

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Skallerup, Harry R. 1955. Some Aspects of State Academy of Science Publications. *Science* 121 (June 24):904–5.

Appendix 1: Publication Information

Title: *Annals of the New York Academy of Sciences*
State: New York
Circulation: 1000
OCLC Libraries: 671
Price: $3050.00
Frequency: Irregular
Indexes: 45

Title: *Bulletin—Southern California Academy of Sciences*
State: California
Circulation: 500
OCLC Libraries: 117
Price: $35.00
Frequency: 3 times per year
Indexes: 8

Title: *Bulletin of the New Jersey Academy of Science*
State: New Jersey
Circulation: 425
OCLC Libraries: 66
Price: $30.00
Frequency: Semiannual
Indexes: 5

Title: *Bulletin of the South Carolina Academy of Science*
State: South Carolina
Circulation: 750
OCLC Libraries: 83
Price: $25.00
Frequency: Annual
Indexes: 4

Title: *California Wild*
State: California
Circulation: 30000
OCLC Libraries: 204
Price: $12.95
Frequency: Quarterly
Indexes: 6

Title: *Encyclia*
State: Utah
Circulation: 1000
OCLC Libraries: 98
Price: $12.00
Frequency: Annual
Indexes: 11

Title: *Florida Scientist*
State: Florida
Circulation: 600
OCLC Libraries: 195
Price: $45.00
Frequency: Quarterly
Indexes: 12

Title: *Georgia Journal of Science*
State: Georgia
Circulation: 550
OCLC Libraries: 122
Price: $40.00
Frequency: Quarterly
Indexes: 10

Title: *Intermountain Journal of Sciences*
State: Montana
Circulation: 275
OCLC Libraries: 139
Price: $25.00
Frequency: Quarterly
Indexes: 2

Title: *Journal of the Alabama Academy of Science*
State: Alabama
Circulation: 900
OCLC Libraries: 135
Price: $25.00
Frequency: Quarterly
Indexes: 9

Title: *Journal of the Arizona-Nevada Academy of Science*
State: Arizona-Nevada
Circulation: 600
OCLC Libraries: 105
Price: $25.00
Frequency: Semiannual
Indexes: 11

Title: *Journal of the Colorado-Wyoming Academy of Science*
State: Colorado-Wyoming
Circulation: 300
OCLC Libraries: 105
Price: $5.00
Frequency: Annual
Indexes: 4

Title: *Journal of the Elisha Mitchell Scientific Society*
State: North Carolina
Circulation: 800
OCLC Libraries: 287
Price: $50.00
Frequency: Quarterly
Indexes: 16

Title: *Journal of the Idaho Academy of Science*
State: Idaho
Circulation: 550
OCLC Libraries: 37
Price: $100.00
Frequency: Semiannual
Indexes: 3

Title: *Journal of the Iowa Academy of Science*
State: Iowa
Circulation: 2000
OCLC Libraries: 130
Price: $35.00
Frequency: Quarterly
Indexes: 16

Title: *Journal of the Kentucky Academy of Science*
State: Kentucky
Circulation: 650
OCLC Libraries: 137
Price: $45.00
Frequency: Semiannual
Indexes: 8

Title: *Journal of the Minnesota Academy of Science*
State: Minnesota
Circulation: 1600
OCLC Libraries: 101
Price: $20.00
Frequency: Semiannual
Indexes: 8

Title: *Journal of the Mississippi Academy of Sciences*
State: Mississippi
Circulation: 400
OCLC Libraries: 161
Price: $25.00
Frequency: Quarterly
Indexes: 8

Title: *Journal of the Pennsylvania Academy of Science*
State: Pennsylvania
Circulation: 700
OCLC Libraries: 82
Price: $40.00
Frequency: 3 times per year
Indexes: 6

Title: *Journal of the Tennessee Academy of Science*
State: Tennessee
Circulation: 1200
OCLC Libraries: 182
Price: $15.00
Frequency: Quarterly
Indexes: 13

Title: *Journal of the Washington Academy of Science*
State: District of Columbia
Circulation: 511
OCLC Libraries: 240
Price: $25.00
Frequency: Quarterly
Indexes: 12

Title: *Michigan Academician*
State: Michigan
Circulation: 1000
OCLC Libraries: 200
Price: $50.00
Frequency: Quarterly
Indexes: 18

Title: *New Mexico Journal of Science*
State: New Mexico
Circulation: 250
OCLC Libraries: 29
Price: $30.00
Frequency: Annual
Indexes: 3

Title: *Ohio Journal of Science*
State: Ohio
Circulation: 2000
OCLC Libraries: 329
Price: $50.00
Frequency: 5 times per year
Indexes: 27

Title: *Proceedings of the Arkansas Academy of Science*
State: Arkansas
Circulation: 450
OCLC Libraries: 90
Price: $45.00
Frequency: Annual
Indexes: 8

Title: *Proceedings of the California Academy of Sciences*
State: California
Circulation: 800
OCLC Libraries: 214
Price: $40.00
Frequency: Irregular
Indexes: 12

Title: *Proceedings of the Indiana Academy of Science*
State: Indiana
Circulation: Undetermined
OCLC Libraries: 255
Price: $12.00
Frequency: Semiannual
Indexes: 18

Title: *Proceedings of the Louisiana Academy of Sciences*
State: Louisiana
Circulation: 600
OCLC Libraries: 105
Price: $15.00
Frequency: Annual
Indexes: 7

Title: *Proceedings of the Nebraska Academy of Sciences*
State: Nebraska
Circulation: 1450
OCLC Libraries: 83
Price: $20.00
Frequency: Annual
Indexes: 2

Title: *Proceedings of the North Dakota Academy of Science*
State: North Dakota
Circulation: 750
OCLC Libraries: 157
Price: $7.50
Frequency: Annual
Indexes: 5

Title: *Proceedings of the Oklahoma Academy of Science*
State: Oklahoma
Circulation: 800
OCLC Libraries: 173
Price: $27.00
Frequency: Annual
Indexes: 17

Title: *Proceedings of the Oregon Academy of Science*
State: Oregon
Circulation: 300
OCLC Libraries: 81
Price: $5.00
Frequency: Annual
Indexes: 3

Title: *Proceedings of the South Dakota Academy of Science*
State: South Dakota
Circulation: 350
OCLC Libraries: 92
Price: $12.00
Frequency: Annual
Indexes: 13

Title: *Proceedings of the West Virginia Academy of Science*
State: West Virginia
Circulation: 450
OCLC Libraries: 140
Price: $200.00
Frequency: Semiannual
Indexes: 13

Title: *Sciences, The*
State: New York
Circulation: 75000
OCLC Libraries: 4342
Price: $21.00
Frequency: Bimonthly
Indexes: 18

Title: *Texas Journal of Science*
State: Texas
Circulation: 1000
OCLC Libraries: 240
Price: $45.00
Frequency: Quarterly
Indexes: 27

Title: *Transactions of the Delaware Academy of Science*
State: Delaware
Circulation: 100
OCLC Libraries: 28
Price: Undetermined
Frequency: Irregular
Indexes: 1

Title: *Transactions of the Illinois State Academy of Science*
State: Illinois
Circulation: 1100
OCLC Libraries: 201
Price: $50.00
Frequency: Quarterly
Indexes: 19

Title: *Transactions of the Kansas Academy of Science*

State: Kansas
Circulation: Undetermined
OCLC Libraries: 110
Price: Undetermined
Frequency: Semiannual
Indexes: 4

Title: *Transactions of the Missouri Academy of Science*
State: Missouri
Circulation: Undetermined
OCLC Libraries: 147
Price: $18.00
Frequency: Annual
Indexes: 6

Title: *Transactions of the Nebraska Academy of Sciences*
State: Nebraska
Circulation: 1450
OCLC Libraries: 86
Price: $20.00
Frequency: Annual
Indexes: 9

Title: *Transactions of the New York Academy of Sciences*
State: New York
Circulation: Undetermined
OCLC Libraries: 525
Price: Undetermined
Frequency: Irregular
Indexes: 7

Title: *Transactions of the Wisconsin Academy of Sciences, Arts and Letters*
State: Wisconsin
Circulation: 1550
OCLC Libraries: 261
Price: Undetermined
Frequency: Annual
Indexes: 12

Title: *Virginia Journal of Science*
State: Virginia
Circulation: 1300
OCLC Libraries: 157
Price: $27.50
Frequency: Quarterly
Indexes: 9

Title: *Wisconsin Academy Review*
State: Wisconsin
Circulation: 2000
OCLC Libraries: 125
Price: $16.00
Frequency: Quarterly
Indexes: Undetermined

Appendix 2: State Academies of Science Publications on the Internet

Full-Text

California Wild
http://www.calacademy.org/calwild/

Journal of the Idaho Academy of Science
http://www.uidaho.edu/ias/
(Full-text of back issues available in future)

Journal of the Iowa Academy of Science
http://www.iren.net/ias/journal/journal.htm
(Full-text available in future)

*Journal of the Mississippi Academy of Science*s
http://www.msacad.org/

Michigan Academician
http://www.umich.edu/~michacad
(Full-text available for subscribers in future)

Transactions of the Kansas Academy of Science
http://www.emporia.edu/www/kas/transact.htm
(Abstracts and some full-text available)

Abstracts/Table of Contents/Index

Annals of the New York Academy of Sciences
http://www.nyas.org/
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Georgia Journal of Science
http://www.gpc.peachnet.edu/~jaliff/gajsci.htm
(Table of contents and abstracts available in future)

Journal of the Iowa Academy of Science
http://www.iren.net/ias/journal/journal.htm
(Abstracts available)

Journal of the Pennsylvania Academy of Science
http://www.ems.psu.edu/~forbes/pas/jourtofc.htm
(Table of contents available)

Journal of the Tennessee Academy of Science
http://tas.rhodes.edu/tas/journalcontents.html
(Images of journal covers include table of contents)

New Mexico Journal of Science
http://nmas.nmsu.edu/nmjs/index.html
(Images of covers and table of contents available for special editions)

Ohio Journal of Science
http://www.ohiosci.org/ojs.htm
(Abstracts from recent issues available)

Proceedings of the Louisiana Academy of Sciences
(Table of contents available in the future)

Proceedings of the Oklahoma Academy of Science
http://bmb-fs1.biochem.okstate.edu/oas/oasHomePage.html
(Table of contents available)

Sciences, The (1997–Present)
http://www.nyas.org/
(Table of contents available)

Texas Journal of Science
http://hsb.baylor.edu/html/tas/tjs.htm
(Table of contents available)

Transactions of the Illinois State Academy of Science
http://www.il-st-acad-sci.org/transactions/transac.html
(Table of contents and abstracts available)

Transactions of the Missouri Academy of Science
http://www2.semo.edu/naugler/mas
(Table of contents available)

Transactions of the Wisconsin Academy of Sciences, Arts and Letters
http://www.wisconsinacademy.org/
(Table of contents available for current issue)

Virginia Journal of Science
http://www.vacadsci.org/
(Table of contents and abstracts available in future)

Wisconsin Academy Review
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Performance of Apple Cultivar/Rootstock Combinations Grown in Mississippi

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Several apple cultivar/rootstock combinations were evaluated for overall performance in northern Mississippi during 1998 and 1999. Parameters measured were fruit set, scion and stock trunk cross sectional area, fruit drop, yield, fire blight (*Erwinia amylovora*) susceptibility, fruit size, firmness, soluble solids content, and juice pH. Combinations evaluated were 'Earligold'/EMLA 7, 'Jonagold'/EMLA 111, 'Improved Golden'/EMLA 7, 'Improved Golden'/EMLA 111, 'Scarlet Gala'/EMLA 7, 'Jonafree'/Mark, 'Macspur'/M7A, 'Royal Gala'/MM 111, and 'Williams Pride'/M 7A. 'Royal Gala' and 'Scarlet Gala' showed maximum fruit set when compared with 'Williams Pride.' Scion cultivars had the greatest trunk diameter on EMLA 111 and MM 111 and the smallest diameter on Mark. Scion cultivars on Mark and M 7A rootstocks showed less susceptibility to fire blight compared to MM 111 and EMLA 111. Cultivars on EMLA 7 showed moderate susceptibility to fire blight. Cultivars 'Jonafree,' 'Williams Pride,' 'Macspur,' and 'Scarlet Gala' were least susceptible to fire blight compared to 'Royal Gala' and 'Improved Golden'. The remaining cultivars were intermediate in susceptibility to fire blight. Rootstock and cultivar influenced total yield per tree. 'Royal Gala,' 'Scarlet Gala,' 'Earligold,' and 'Improved Golden' produced high yield. Cultivars on MM 111, EMLA 111, and EMLA 7 resulted in the greatest yield per tree, while cultivars on Mark and M7 produced the lowest yield per tree. Firmest fruit was found in 'Jonafree'/Mark, while the least firm fruit was found in 'Williams Pride'/M 7A,'Earligold'/EMLA 7, and 'Scarlet Gala'/EMLA 7. Soluble Solids Concentration (SSC) was not influenced by cultivar/rootstock combinations. In general, SSC ranged from 12 to 14 percent. Juice pH differed among cultivar/rootstock combinations. The highest pH was recorded for 'Royal Gala'/MM 11 l and 'Williams Pride'/M 7A, and the lowest pH was recorded for 'Jonafree'/Mark and 'Macspur'/ M7.

In the southern United States, apples are primarily sold for the fresh market. Intense management, such as, irrigation, proper insect and disease control, timely harvest, and proper marketing are necessary to make fruit production profitable (Matta et al., 2000). In the south, commercial apple industries are concentrated in North Carolina (1.7%), South Carolina (0.4%) and Georgia (0.2%) (Rom, 2000). Adequate chilling is the main difference in apple production between North and South of the country (Walton, 1988). Most commercially produced apple cultivars require winter chilling between 1000–1600 hours (Westwood, 1993). Often times insufficient chilling occurs in the south. The absence of cool nights in the south, during the fall ripening period cause apples to ripen early and develop poor red color (McEachern,1978). Recently, apple production has expanded into Mississippi where the apple industry is young and growing. Apple orchards in Mississippi range from 5 to 25 acres in size and are concentrated in the northern one third of the state where chilling is considered to be sufficient (Matta, 1995). Studies conducted by Khan (1993) in northern Mississippi, showed that rootstock can influence early growth, foliar composition, and some physiological aspects of grafted cultivars. Other cultivar/rootstock evaluations in northern Mississippi have reported shoot growth, budbreak, leaf area, and yield of grafted trees (Siswanto, 1994 and 2000; Fandi, 1997; and Rauf, 1998). However, the information of cultivar/rootstock combinations in the southern United States and Mississippi is limited. There is demand for information concerning cultural practices, fruit quality, performance of cultivars and rootstocks for apple (Rasberry, 2000). In addition, fire blight (*Erwinia amylovora*) is a limiting factor in

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apple production in the south. While rapid growth is desirable, such growth makes apple trees more susceptible to fire blight, one of the major disease problem in apple production (Van der Zwet and Keil, 1979). Sloan et al. (1996), and Salcedo et al. (2000) conducted preliminary evaluations on the effect of various cultivars and foliar nutrients on fire blight susceptibility in northern Mississippi. 'Empire,' 'Braeburn,' and 'William's Pride' were least susceptible to fire blight. 'Blushing Golden,' 'Earligold,' and 'Royal Gala' were most susceptible to fire blight when evaluated by the Van der Zwet System. Rootstocks Mark and M26 showed less susceptibility to fire blight compared to MM 111, EM 111, and EM7. In the United States, approximately 5.4 million tons of apples are produced traditionally in Washington, Oregon, California, New York, Michigan, Kansas, Virginia, Ohio, Massachusetts, and North Carolina (Anonymous, 1998; Childers et al., 1995). Abundant information is available in apple production, including apple breeding programs which develop superior apple cultivars to meet the needs of the growers in northern United States (Brown and Terry, 1997). Such information, does not readily apply to the southern states because of the unique climate, and unique characteristics of some apple cultivars. Growers need information concerning the performance of apples cultivars grown under Mississippi conditions. Tree growth and development can be markedly influenced by both cultivar and rootstock (Hirst and Ferree, 1995). The influence of scion and rootstock can impact tree size, growth, fruit quality, and yield (Hartmann et al., 1990). The combinations of different clonal rootstock with different scion cultivar allow much refinement in the performance of grafted trees. Each particular scion-stock combination requires thorough testing before its performance is established and can be predicted (Hartmann et al., 1990). It is necessary to know the specific attributes of scion stock combinations to use them to an advantage (Obernofer, 1990). Schechter et al. (1991) determined that rootstocks strongly influenced the number, area, dry weight, and percent of leaves in each cultivar studied. Dwarfing rootstocks have become widely accepted by the industry as a tool for increasing orchard efficiency because they influence the size of the tree, yield and planting density per unit area (Barritt et al., 1995). The objective of this study was to determine the most suitable cultivar/rootstock combinations adapted to Mississippi climatic conditions among the combinations tested.

MATERIAL AND METHODS

This study was conducted at the Pontotoc Ridge-Flatwoods Research and Extension Center (38° 08' N, 89° 00' W) under the supervision of Dr. Frank B. Matta, professor of Horticulture at Mississippi State University, Department of Plant and Soil Sciences. The station is located seven miles south of Pontotoc, MS. The average annual maximum temperature of this area is 30° C (86° F) and minimum is -1°C (30°F), with annual rainfall of 81.28 cm (32 inches). The total dormancy period is approximately 1100 hours per year. Soil at the station is classified as Alfisol, Ultisol, Inceptisol, and Entisol orders with deep red color, high in silt to silt loam. Apple trees used were planted in 1993 and spaced 8 feet in rows and 12 feet between rows. Trees were pruned to a modified central leader system. The soil pH was 5.6. In May 1998 and 1999, a 5-20-20 fertilizer was applied at a rate of 450 g per tree, and ammonium nitrate (34-0-0) at a rate of 230 g per tree. No irrigation was applied. Weeds were controlled in the row by application of Round-up herbicide in a 1 m strip, and a mowed strip was maintained between rows. Insects and diseases were controlled through a spray program as recommended by MS Cooperative Extension Service.

'Earligold'/EMLA 7, 'Jonagold'/EMLA 111, 'Improved Golden'/EMLA 7, 'Improved Golden'/EMLA 111,'Scarlet Gala'/EMLA 7, 'Jonafree'/Mark, 'Macspur'/M 7A, 'Royal Gala'/MM 111, and 'Williams Pride'/ M 7A cultivar/rootstock combinations were evaluated during 1998 and 1999. Fruit set data were collected from three trees per combination and five limbs per tree and percentage fruit set calculated. Trunk diameter of scions one inch above the graft union were measured with a hand caliper at the beginning of the growing season. Stock diameter two inches (5 cm) below the graft union was also recorded. Trunk cross sectional area was calculated with the formula $0.785 \times d^2$, in which d was tree diameter. Fire blight susceptibility was determined using the rating system developed by van der Zwet et al (1979). The score on the van der Zwet rating system is based in the number of branches infected, the age of the wood blighted, and the percentage of canopy that is blighted (Sloan et al., 1996). The scoring system ranges from 10 to 1, where 10 indicates no fire blight symptoms and 1 indicates death of the tree. Fruit size expressed as fruit length and fruit diameter was measured using a vernier caliper. Fruit firmness was measured using a penetrometer (Instron Universal Machine, Model 1011 (Canton, Mass). Fruit fresh weight was determined using a Mettler PC 8000 scale. Juice soluble solids content (SSC) was measured with a Bausch & Lomb Abbe 3L refractometer, and juice pH was measured using an Accumet pH meter 925 (Fisher Scientific Pittsburgh, PA).

The experimental design used was a completely randomized design with repeated measures and three single tree replications. Data was analyzed using PROC GLM (SAS Statistical Software, SAS Institute, Cary, N.C.). Treatment means were separated by the LSD test, 5% significance level.

RESULTS AND DISCUSSION

In 1998, fruit set was greater in 'Royal Gala'/MM 111 than 'Williams Pride'/M 7A (Figure 1). In 1999, fruit set was greater in 'Royal Gala'/MM 111 and 'Scarlet Gala'/EMLA 7, while the lowest fruit set was in 'Williams Pride'/M 7A and 'Macspur'/ M7A with 43 and 49 percent, respectively. Fruit set did not differ among the remaining cultivar/rootstock combinations. Similar results by Shupp (1995) who evaluated growth and performance of four apple cultivars on M26 and Mark rootstocks showed that fruit set was unaffected by rootstock and there was no cultivar/rootstock interaction.

In 1998, 'Jonagold' on EMLA 111 produced greater trunk scion or rootstock diameter compared to 'Jonafree' on Mark and did not differ from cultivars on MM 111, and EMLA 7 (Figure 2). In 1999, 'Jonagold'/EMLA 111 I was the most vigorous combination and 'Jonafree'/Mark and 'Earligold'/EMLA 7 the least vigorous combinations. These results were similar to those presented by Siswanto (2000). Differences in trunk scion or rootstock cross sectional area are indicative of the size controlling character of rootstocks (Dolp and Proebsting,1989). Previous studies also found scion and rootstock interaction for tree size and attributed rootstock to be the predominant factor controlling size (Hirst and Ferree, 1995). Small trunk diameter produced by Mark is a genetic trait transferred from the rootstock to the scion. Reduced cambial activity

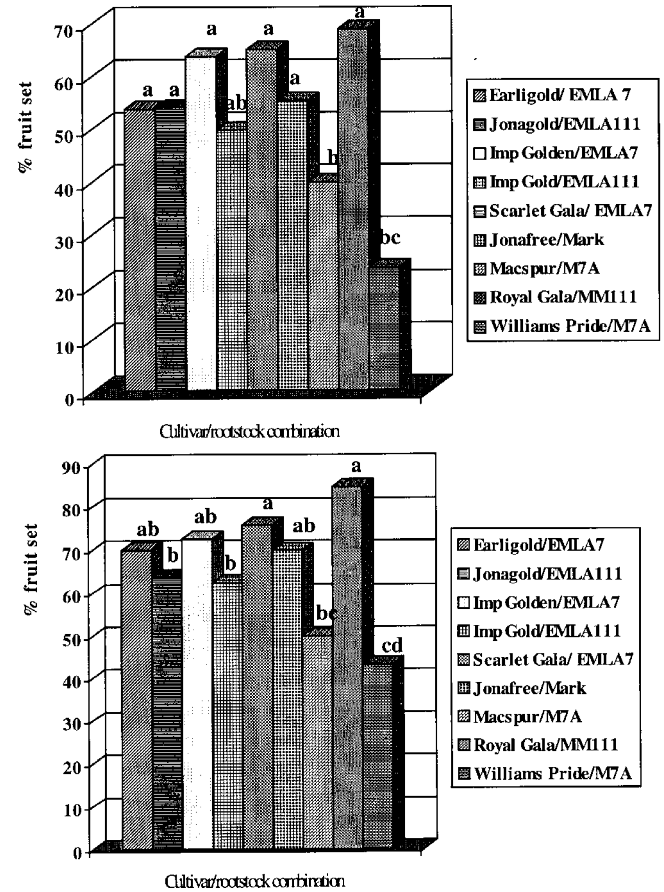

Figure 1. Percentage fruit set of apple cultivar/rootstock combinations in 1998 (top) and 1999 (bottom).

and subsequent xylem formation in the dwarf rootstocks has been reported. The abnormal xylem produced is less efficient in conduction causing a dwarfing effect and smaller trunk diameter (Soumelidou et al., 1994).

In 1998, 'Royal Gala'/MM 111 was the highest producer and 'Jonafree'/Mark the lowest. In 1999, the highest yielding combinations were 'Royal Gala'/MM 111 and 'Scarlet Gala'/EMLA 7 compared to all combinations except to 'Earligold'/EMLA 7 and 'Improved Golden'/EMLA 111. The lowest yielding were 'Jonafree'/Mark and 'Macspur'/M7A (Figure 3). Elfving and Schechter, (1993) reported that annual yields per tree for 'Starkspur Supreme Delicious' trees on nine dwarfing rootstocks were related linearly to the number of fruits per tree at harvest, independent of rootstock. They concluded that there is a linear relationship between yield and fruit count per tree during nine years and suggested that the sink strength of an apple crop is almost

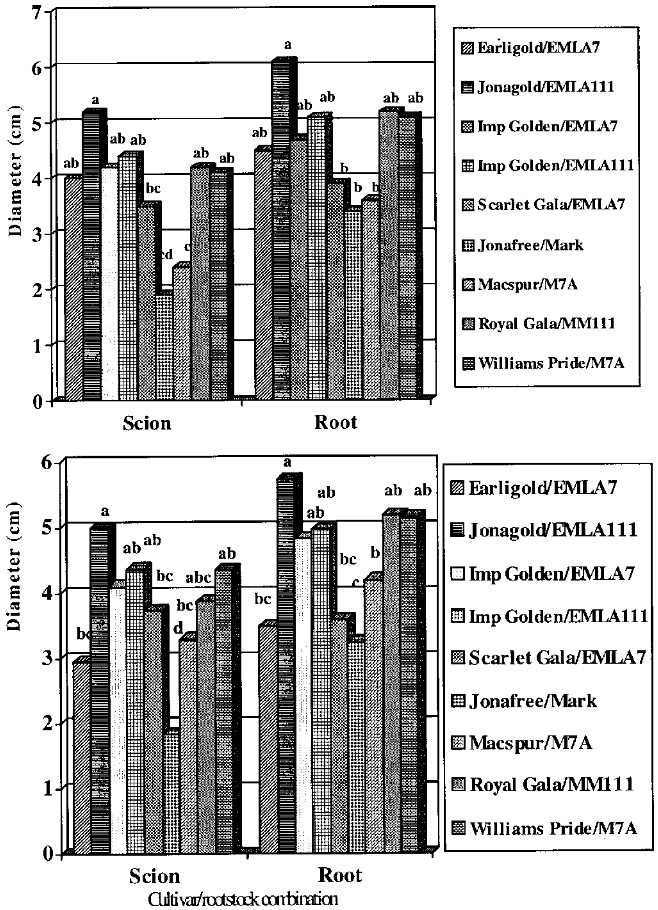

Figure 2. Scion and rootstock diameter of apple cultivars in 1998 (top) and 1999 (bottom).

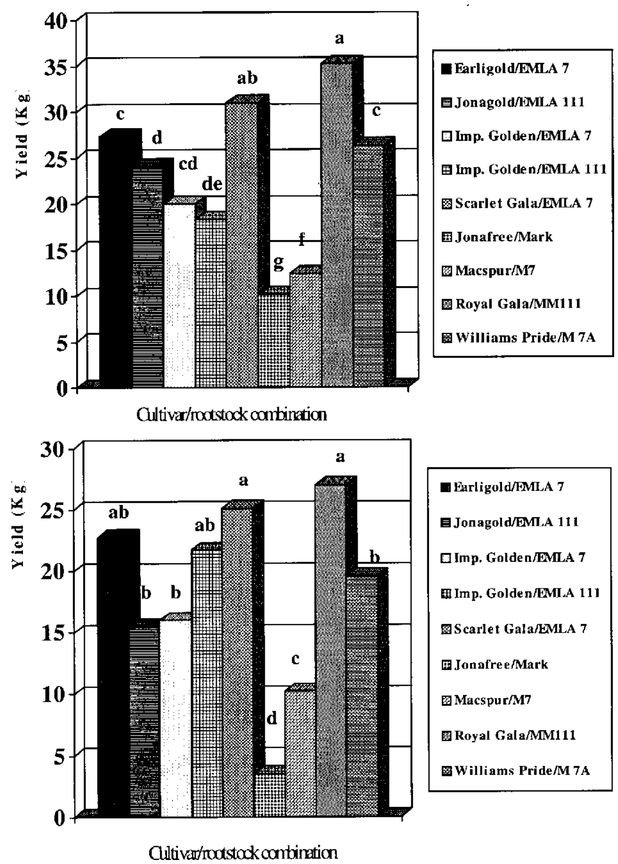

Figure 3. Influence of scion and rootstock on yield per tree (kg) in 1998 (top) and 1999 (bottom).

proportional to the number of fruit per tree.

In 1998, 'Jonafree'/Mark, 'Williams Pride'/M7A, and 'Scarlet Gala'/EMLA 7 showed less susceptibility to fire blight compared to 'Golden Improved'/EMLA111, and 'Royal Gala'/MM111 (Figure 4). In 1999, visual evaluation showed that 'Jonafree'/Mark had the highest rating of 9.85, indicating high fire blight resistance. 'Royal Gala'/MM 111 and 'Improved Golden'/EMLA 111 had the lowest rating of 6, indicating a susceptibility of 13–25%, with many infections in the upper 1/4 of the scaffold limbs. Dwarfing and semi-dwarfing rootstocks present less apple tree loss by fire blight than those from seedling rootstocks. Similar results were presented by Sloan et al., (1996). Rasberry (1997) and Lockwood (2000) noted that fire blight is a limiting factor in apple production in Mississippi.

In 1998, maturity indexes showed significant differences among cultivar rootstock combinations (Table 1). 'Jonagold'/EMLA 111, 'Williams Pride'/M7A, 'Improved Golden'/EMLA 7 or EMLA 111, 'Scarlet Gala'/EMLA 7 and 'Royal Gala'/MM 111 had larger fruit than 'Jonafree'/Mark and 'Macspur'/M 7A. The same trend in fruit size among cultivar/rootstock combinations was observed in 1999. Other studies (Barritt et al., 1994), showed that fruit size was smaller on the most dwarfing rootstock and larger with the semi vigorous and vigorous rootstocks such as M27, M26E, and P.18, respectively. The physiological mechanisms by which dwarfing rootstocks affect fruit characteristics can be due to the reduction in transport of nutrients and hormones, especially gibberellins across the scion/rootstock union.

In 1998, 'Scarlet Gala'/EMLA 7, 'Jonagold'/EMLA 111, and 'Macspur'/M 7A had firmer fruit than the remaining scion/rootstock combinations. 'Williams Pride'/M7A and ' Earligold' /EMLA 7 showed less firmness at harvest. In 1999, 'Jonafree'/Mark had firmer fruit than ' Williams Pride'/ M

7A and ' Earligold'/EMLA 7. The remaining cultivars did not differ in firmness. Firm fruit in Mark in 1999 may be due to small fruit size. Similar results were found by Drake et al., (1988), who found firmest fruit in trees on dwarfing rootstocks than in fruit from semi dwarfing and vigorous rootstocks.

Juice soluble solids concentration (SSC), in general, was not influenced by scion/rootstock combinations in 1998 and 1999. High SSC value in Mark could be attributed to enhanced light distribution withing tree canopies with optimized total canopy interception (Siswanto, 2000). High exposure of fruit and leaves to light may increase SSC in the fruit, compared to fruit that has poor exposure to light (Tustin et al., 1988).

In 1998, 'Royal Gala'/MM 111, 'Scarlet Gala'/EMLA 7 and 'William's Pride'/M7A had higher juice pH values than 'Jonafree'/Mark and 'Macspur'/M7A (Table 1). In general, juice pH ranged from 3.39 to 3.99 for the highest combination. In 1999, again 'Royal Gala'/MM 111 and 'Williams Pride'/M 7A had the highest juice pH than the remaining combinations. 'Jonafree'/ Mark and 'Macspur'/M7A combinations produced the lowest pH over two years (Table 1). These results agree with those presented by Lau (1988), who reported that acidity at harvest varies with the scion cultivar.

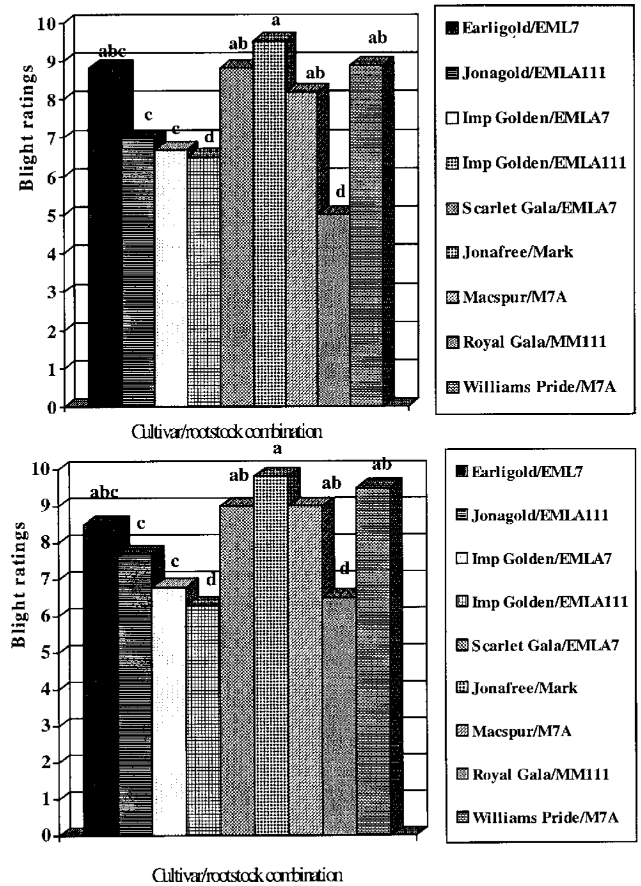

Figure 4. Fire light rating of apple cultivar/rootstock combinations grown in Mississippi in 1998 (top) and 1999 (bottom).

CONCLUSIONS

Nine cultivar rootstock combinations were established to identify their performance and to determine the most suitable for northern Mississippi. For both years, 'Royal Gala'/MM 111 and 'Scarlet Gala'/EMLA 7 showed adaptability to Mississippi conditions, based on fruit size, percentage of fruit set, total yield, and maturity indexes at harvest. During 1998 and 1999, 'Jonagold'/EMLA 111 and 'Improved Golden'/ EMLA 111 or EMLA 7 produced heavier and longer fruit and had a greater scion diameter compared to the remaining combinations, indicating that such plant combinations were vigorous. Another combination that had good overall performance was 'Williams Pride'/M7A. However, this combination had a substantial amount of fruit drop. 'Jonafree'/Mark, 'Williams Pride'/M7A, 'Macspur'/M7A, and 'Scarlet Gala'/EMLA 7 were least susceptible to fire blight compared to 'Royal Gala'/MM 111 which showed to be the most susceptible combination to this disease. Evaluations for long term performance and postharvest quality will continue. Scion/rootstock combinations such as 'Jonafree'/Mark and 'Macspur'/M7A may not be good combinations for Mississippi conditions due to small fruit size, low fruit weight, and low fruit set percentage in this two year study.

Table 1. Maturity Indices of Apple Cultivars Measured at Harvest Time, 1998 and 1999

Cultivar	Diameter (cm)		Length (cm)		SSC (EBrix)		pH		Firm (N)	
	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999
Earligold	72.9 cd	67.8 b	69.1 cd	59.7 bcd	13. 0 e	12.8 bc	3.55 d	3.63 cd	068.5 d	084.8 d
Jonagold	81.0 a	75.5 a	70.3 cd	63.3 a	13.53 bc	13.9 ab	3.58 cd	3.6 d	151.2 ab	113.7 c
Imp. Golden	81.4 a	67.4 bb	77.0 a	62.5 ab	13.60 b	14.1 a	3.65 c	3.7 c	145.5 b	132.9 bc
Imp. Golden	74.7 c	63.3 bc	72.3 bc	56.8 d	13.56 bc	14.1 a	3.62 c	3.7 c	133.5 bc	145.5 b
Scarlet Gala	72.3 cd	64.6 bc	69.7 cd	58.2 cd	13.70 a	13.9 ab	3.91 b	3.75 bc	156.0 a	151.2 ab
Jonafree	63.2 f	56.3 d	57.8 g	45.7 e	13.65 ab	14.4 a	3.39 f	3.45 e	113.7 c	156.0 a
Macspur	68.9 e	57.5 d	63.8 e	46.2 e	13.45 cd	13.4 b	3.46 e	3.4 ef	137.4 ab	134.3 bc
Royal Gala	78.6 b	65.5 bc	73.9 b	59.1 cd	13.58 b	13.5 b	3.99 a	3.86 a	132.9 bc	133.5 bc
William's Pride	80.9 a	74.1 a	69.9 d	60.3 abc	13.54 bc	13.9 ab	3.91 b	3.84 a	081.6 d	068.5 d

Means separated (by letters) in columns by Duncan's multiple range test, P >0.05

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Comparison of Metabolic Rates of Guppy, *Poecilia reticulata* (Poecilidae), and Black Molly, *Poecilia latipinna* (Poecilidae), at Different Temperatures

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This research was designed to compare the metabolic rates *(mRs)* of guppy, *Poecilia reticulata* (Poecilidae) and black molly, *Poecilia latipinna* (Poecilidae) at 23–25ºC and at 15ºC, using the indirect respirometry. Most aquaria kept at homes are maintained in the 23–25ºC temperature range. The 15ºC was chosen to test the fishes' survivability at a lower temperature and to compare the *mRs* at different temperatures. Guppies and mollies are popular, small aquarium pets. The male guppies are about 3 centimeters long and are naturally smaller than the male black mollies. Both fishes, along with other similar aquarium pets, are viviparous; which enabled them to occupy an important niche in fish evolution. Using end-point titration, we measured the metabolic carbon dioxide (CO_2) produced by the guppy and the black molly that displaced 1 and 2 milliliters of water, respectively. Endpoint data collected were adjusted and used to calculate the *mRs* in µM CO_2/ml/hr. The average *mRs* of the guppy was found to be 7.11, 10.45, 11.58, and 9.02 µM CO_2/ml/hr at 15, 23, 24, and 25ºC, respectively. The black molly at the above temperatures had average *mRs* of 4.78, 6.6, 7.40, and 5.78 µM CO_2/ml/hr, respectively. Both fishes survived testing at 15ºC. The black molly however, regulated its *mR* much more tightly (5.4 to 4.5 µM CO_2/ml/hr) at 15ºC than the guppy did (8.0 to 6.3 µM CO_2/ml/hr) in the same temperature range. The two species responded metabolically to changes in water temperature. But, it is unclear how much of the observed differences in *mR* were due to species or weight differences. Similar research using the female guppies which can measure up to 6 cm long and the female black mollies of the same body weight is recommended to resolve the question on weight differences.

Guppy and black molly are small, tropical aquarium pets. The male guppy is about 3 cm long and by nature is smaller than the male black molly. Both the guppies and the black mollies are closely related to the swordtails, platys and mosquito fish. Their uniqueness as live bearers has enabled them to occupy an important niche in the evolution of fishes. Guppy is a native to the fresh waters of Venezuela and the Caribbean Islands, where water temperature is usually at least 20ºC. The demand for guppy in the last decade has increased immensely that it now rivals goldfish as the world's most popular aquarium pet. Molly on the other hand, is generally found in the fresh-waters between Mexico and Venezuela. It is particularly vulnerable to cold temperatures. Ready availability from commercial sources and low maintenance make both fishes very attractive for use in research. The guppies in particular have already been dubbed the laboratory mice in the aquaria. However, majority of natural habitats for the guppy and the molly and other live bearers is under threat through improper landscaping, logging, or recreational use.

Guppy and black molly, like many other gill-breathing animals, continually exchange carbon dioxide for oxygen with their ambient environment. Most fishes further enhance exchange of gases by using ram ventilation (Muir and Kendall, 1968; Eckert and Randall, 1983), or the buccal-opercular pump (Steffensen and Lamholt, 1983; Steffensen, 1985). Additionally, many fishes are able to switch selectively between the two modes of gas exchange. Steffensen (1985) suggested possible involvement of both chemoreceptors and mechanoreceptors in the mode-switching reflex. At the cellular level, oxygen is used as the final electron acceptor during aerobic respiration. As a result, energy, metabolic carbon dioxide and water are produced (Pelster and Dried-

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zic, 1994; Pelster, 1995a, 1995b; Pelster and Pott, 1996). The rate of production of metabolic carbon dioxide depends on the animal's complexity, activity level, and temperature. These same factors also affect the amount of oxygen the animal consumes (Hughes, 1965). In this research we quantified the metabolic rates *(mRs)* of guppy (*Poecilia reticulata)* and the black molly *(Poecilia latipinna)* using the indirect respirometry at 23–25ºC and at 15ºC. The latter technique enabled measurements of metabolic rates *(mRs)* using the produced carbon dioxide as a target molecule.

MATERIALS AND METHODS

This research was conducted at Mississippi Valley State University, Itta Bena, MS from October 1997 to April 2000. Three 10 gallon aquarium tanks filled with de-chlorinated tap water were stocked with guppies and black mollies from a local supplier. Each guppy was found to displace 1 ml of water in a graduated cylinder while each molly displaced 2 ml of water in a graduated cylinder. The water in the stock tanks were continuously filtered and aerated with Aqua-Tech filtration units. All fishes were allowed to acclimate for about two weeks before use in the experiment (Hochachaka and Somero, 1971). Fishes were fed once a day with Tropical flakes . The research methods we used were modified from Skavaril et al. (1993). Fifty ml of aquarium water at 23ºC was measured with a graduated cylinder and poured into three, clean 100 ml beakers labeled 1, 2, and 3. A guppy and a black molly were scooped each from its tank with a dip net and gently transferred into beakers 2 and 3, respectively. Beaker 1 served as the control setup. Each beaker was tightly sealed with a clinging-plastic wrap and secured with a rubber band. The setups were then allowed to sit undisturbed for 30 minutes, during which the fishes carried on their routine activities. Next, the plastic seal was quickly removed from the three test-beakers and the fishes in beakers 2 and 3 were transferred with a perforated plastic spoon into 50 ml graduated cylinders. The latter cylinders contained 20 ml of aquarium water that was taken from the respective stock tanks. Contamination or loss of water from the above beakers was avoided during the fishes' transfer by using dedicated, perforated plastic spoon for each fish and completely draining all the water from the spoon back into the beaker.

Eight drops of phenolphthalein solution were then added to the test-waters in each of the three beakers as a color indicator. The test-waters were each titrated to endpoint with a burette that contained 2.5 µM of sodium hydroxide (NaOH) solution. The amount of NaOH solution used to neutralize the carbonic acid in the control was deducted from the amounts used in beakers 2 and 3. The resulting data represent the adjusted volumes of NaOH used for the test-waters in beakers 2 and 3 that previously contained the test fishes and hence, were used to calculate the metabolic rates (*mRs*) of the fishes in µM CO_2/ml/hr. The mass of each fish was determined as the difference between the final and the initial water volumes in the 50 ml graduated cylinders. The above procedures were repeated at 24, 25, and 15ºC and the fishes were rested 24 h between tests. The *mR* was calculated using the formula: *mR* = [ml NaOH (adjusted)] x [2.5 µM NaOH/ ml] ' [Fish volume (ml)] x [0.5 hr].

RESULTS

The *mRs* of black molly at 23 to 25ºC ranged from 5.0 to 14.3 µM CO_2/ml/hr (Table 1). For guppy in the above temperature ranges, the *mRs* ranged from 9.0 to 13.5 µM CO_2/ml/hr (Table 1). The average *mRs* for guppy were 10.45, 11.58, and 9.02 µM CO_2/ml/hr at 23, 24, and 25ºC (Table 2). In comparison, the average *mRs* for black molly at the above temperatures were 6.6, 7.40, and 5.78 µM CO_2/ml/hr (Table 2). At 15ºC the *mRs* of the black molly ranged from 4.5 to 5.4 µM CO_2/ml/hr (Table 3). Also at 15ºC, the *mRs* of guppy ranged from 6.3 to 8.0 µM CO_2/ml/hr (Table 3). Figure 1 shows the average *mRs* of black molly and guppy in µM CO_2/ml/hr at 15ºC and at 23 to 25ºC. Metabolism for both fishes was lowest at 15ºC and highest at 24ºC (Fig. 1). No mortality was observed at any of the temperatures tested.

DISCUSSION

In the absence of high technological equipment, the indirect respirometry is a low cost and effective means of measuring the metabolic rates of small aquatic animals. Our data show that both the guppy and the black molly actively carried on metabolic processes during the test periods. The metabolic rates (*mRs*) for both fishes appear to increase as the ambient temperature increased (Fig. 1). Such increases in *mR* relative to rising temperatures do not go on indefinitely, as is the case with the two fish species we tested.

The increases in the *mR* that both species exhibited were gradual from 15 to 24ºC before dropping at 25ºC. The decline in the *mR* observed for the guppy and the black molly after 24ºC suggests that both fishes may have definite upper temperature tolerance for routine activities. The latter are activities supported by routine metabolism. Generally, when routine metabolism occurs, it permits fish to swim continuously, undisturbed, and without tiring (Hughes, 1965; Fry, 1971; Milligan, 1996). Such swimming has also been described as steady-state swimming and to involve a broad range of swimming speeds (Milligan, 1996), as are frequently observed in most home aquarium tanks. Routine metabolism is important for fish normal cruises in its territory and for long distance travels. Both activities are also essential for fish survival and are largely supported by aerobic respiration, which occurs in the red muscles. There, the pyruvate molecules are metabolized to CO_2 and H_2O in the mitochondria using oxygen molecules as the final electron acceptors.

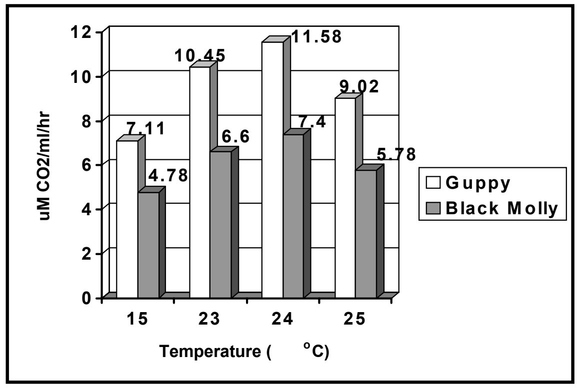

Figure 1. Average metabolic rates of guppy (*Poecilia reticulata*) and black molly (*Poecilia latipinna*) based on metabolic carbon dioxide produced in µM/ml/hr.

Table 1. Metabolic rates of guppy (*Poecilia reticulata)* and black molly (*Poecilia latipinna*) based on metabolic carbon dioxide produced at 23–25ºC. Gu, guppy, and Bm, black molly.

Experiment		2.5 µM NaOH solution used (ml)					CO_2Produced (µM/ml/hr)	
Test No.	Temp. ºC	Experimental Setup		Control Setup	Adjusted Volume			
		Gu	Bm		Gu	Bm	Gu	Bm
1	23	2.40	3.40	0.20	2.20	3.20	11.00	8.00
2	23	2.20	2.40	0.40	1.80	2.00	9.00	5.00
3	23	2.50	2.70	0.40	2.10	2.30	11.50	5.57
4	23	2.60	2.50	0.45	2.15	2.05	10.75	5.13
5	23	2.40	3.40	0.40	2.00	3.00	10.00	7.50
6	24	3.00	6.00	0.30	2.70	5.70	13.50	14.30
7	24	3.00	2.80	0.55	2.45	2.25	12.30	5.63
8	24	2.50	3.75	0.45	2.05	3.30	10.30	8.25
9	24	2.70	2.80	0.40	2.30	2.40	11.50	6.00
10	24	2.65	3.75	0.50	2.15	3.25	10.80	8.13
11	25	2.85	3.15	0.45	2.40	2.70	12.00	6.75
12	25	2.70	4.00	0.45	2.25	3.55	11.30	8.88
13	25	2.50	3.00	0.45	2.05	2.55	10.30	6.38
14	25	2.80	3.20	0.45	2.35	2.75	11.75	6.88
15	25	2.60	3.60	0.45	2.15	3.15	10.80	7.90

The black molly we tested has twice the mass of the guppy. The guppy consistently showed a higher *mR* at each temperature tested. This observation supports the general knowledge that smaller animals tend to have higher *mRs* when compared to larger animals on equal weight basis (Hughes, 1965). Black mollies are particularly vulnerable to cold temperatures. This may explain why they regulated their *mRs* much more tightly, between 4.5 and 5.4 µM CO_2/ml/hr at 15°C, as compared to the guppy (6.3 to 8.0 µM CO_2/ml/hr) at the same temperature. It is unclear how much of the differences in *mR* that we observed is purely attributable to differences in species, and if any, to weight differences. Additional study is therefore warranted to resolve the point of differences.

Table 2. Average metabolic rates for guppy (*Poecilia reticulata*) and black molly (*Poecilia latipinna*) based on metabolic carbon dioxide produced in µM/ml/hr.

Fish	15ºC	23ºC	24ºC	25ºC
Guppy	7.11	10.45	11.58	9.02
Black Molly	4.78	6.60	7.40	5.78

Table 3. Metabolic rates of guppy (*Poecilia reticulata*) and black molly (*Poecilia latipinna*) based on metabolic carbon dioxide produced at 15ºC. Gu, guppy, and Bm, black molly.

Test No.	2.5 µM NaOH solution Used (ml)					CO_2 Produced (µM/ml/hr)	
	Experimental Setup		Control Setup	Adjusted Volume			
	Gu	Bm		Gu	Bm	Gu	Bm
1	1.90	2.45	0.30	1.60	2.15	8.00	5.40
2	1.60	2.10	0.30	1.30	1.80	6.50	4.50
3	1.50	2.10	0.25	1.25	1.85	6.30	4.60
4	1.65	2.15	0.35	1.30	1.80	6.50	4.50
5	1.75	2.25	0.35	1.40	1.90	7.00	4.80
6	2.05	2.30	0.45	1.60	1.85	8.00	4.60
7	1.75	2.25	0.45	1.30	1.80	6.50	4.50
8	2.00	2.45	0.40	1.60	2.05	8.00	5.10
9	1.85	2.40	0.40	1.45	2.00	7.30	5.00
10	1.75	2.25	0.35	1.40	1.90	7.00	4.80

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On the Use of Probability Calculations in the Critique of Evolution

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It is not easy to test evolution experimentally, mostly due to the near impossibility of controlled experimentation and, consequently, the lack of reproducibility. Thus the evolution theory is not universally accepted even among scientists. The crucial concept of evolution is the spontaneity of evolutionary changes: life as we observe it today emerged and evolved as a result of interactions between environment on one side and biomolecules or, later, cells and organisms, on the other side. No intervention of an intelligent designer is necessary at any point. Scientists opposed to this notion argue that life is so complex, especially at the molecular level, that it is statistically impossible for it to rise and evolve spontaneously by small evolutionary steps. To support their claims they often use probability calculations that invariably lead to the conclusion that the odds against emergence of, e.g., the eye, a biochemical pathway, or life as a whole, are some ridiculously high number. Consequently, organisms and their constituents could not have evolved spontaneously, but must have been designed by a goal-oriented, prescient, intelligent designer.

Enzyme cascades, such as the immune complement system or blood clotting, and biochemical pathways are the favorite targets of the "designists" since the coordinated presence and functioning of many factors, connected in series, seems absolutely necessary for the final result to occur, i.e., destruction of a microbe, formation of a blood clot, or synthesis of a metabolite. Missing only one link in the chain results in no effect at all and thus it is not possible to have a partial and step-wise improvement, which is a central principle of evolution. This apparent paradox disappears with the realization of three facts. First, genes, biochemical pathways, and organs do not evolve *de novo* and randomly. Evolution does not work as a random number generator and does not create anything from nothing. It only can modify preexisting systems, which greatly limits the number of possible evolution pathways and outcomes. Systems with new small modifications may exhibit selective advantage over the systems without those modifications, which is referred to as natural selection. The interplay between the limits, imposed by a system's prehistory, and natural selection imparts a continuity and apparent directionality to the whole process. For example, Dawkins (1996) has solved the darwinists' "difficulty" with the evolution of the eye by proving that intermediary steps do exist and that to sense some light is better (in the evolutionary sense) than not to sense any. Complex structures and pathways were thus forged by natural selection, but probabilistic calculations rarely take it into account. Second, many biological systems did not evolve for the function they fulfill today. Rather, they adopted the given new function when the environment allowed for it. For example, the Krebs cycle did not evolve originally to feed NADH to the electron transport chain; it was co-opted for that purpose with the accumulation of oxygen in the atmosphere. And third, many biochemical pathways are not true all-or-none systems. They are organized in cascades not in order to produce the final effect, but rather to ensure a better control and/or amplification of the process in question. For example, one of the active components of the complement, C3b, is formed spontaneously and is constantly present in serum at a low level; other complement components modulate, i.e., decrease or increase, C3b concentration as necessary. The three above-mentioned notions should be a part of any serious evolutionary considerations, but the scope of the present paper is limited. I do not discuss the mechanics of gene duplication or exon shuffling which are the main means by which new molecules arise (Graur and Li, 2000). I also do not address the big philosophical issues in the discourse between the darwinists and the "designists". My modest goal is to point out flaws in the probabilistic reasoning applied to evolution by the latter and show that, even in the absence of all the higher-level evolutionary mechanisms, mere random shuffling of molecules and their parts, when interpreted correctly, may lead to interesting results. As a particular example, the quantitative argument of Behe (1996) against the evolution of tissue plasminogen activator (TPA) is subjected to criticism.

TPA is an enzyme that participates in the biochemical cascade of blood clotting. Behe's argument is reproduced below, almost verbatim (p. 93 of Behe, 1996). A model animal with blood-clotting cascades is said to have about 3×10^4 genes, which code for proteins or protein domains. TPA has four different types of domains. Therefore, putting the four specific domain types together in the enzyme molecule by chance is an event with the probability of about 10^{-18}. Behe's calculation is straightforward and simple, although simplified: TPA actually consists of five domains, two of the five being identical; also, all the details of the machinery necessary for gene shuffling and protein expression have been neglected. But the calculation is followed by sheer demagoguery, whose only aim is to disorient the reader and to make the probability of forming TPA look extremely small. Behe continues: "Now, if the Irish Sweepstakes had odds of winning of one-tenth to the eighteenth power, and if a million people played the lottery each year, it would take an average of about a thousand billion years before anyone (not just a particular person) won the lottery. A thousand billion years is roughly a hundred times the current estimate of the age of universe." (p. 94). It is most puzzling why only million people participate in Behe's Irish Sweepstakes and why the drawing is carried out only once a year, but such numbers conveniently assure the author the desired small probability. Are such numbers relevant to the world of molecular or cellular biochemistry? I am afraid not. One just needs to realize that the model animal consists of about 10^{12} cells and each cell carries the whole set of genes. Therefore, a single animal provides the opportunity to carry out 10^{12} different shufflings in its cells to make a TPA molecule. If we multiply that number by the number of animals of the given species populating the whole Earth, say 10^9, suddenly we have the opportunity to carry out 10^{21} shufflings when the cells in all the animals divide. How often cells divide depends on the cell type and the tissue. Let us assume that an average cell divides once in three days, which means that in one year it divides about 10^2 times. Thus, in one year, the population of our model animals can undergo 10^{23} gene reshufflings to create the TPA molecule by chance. Comparing this result to Behe's number leads to the conclusion that the animal population (of a single species) on the planet can carry out sufficient number of reshufflings to produce about 10^5 TPA molecules each year—by blind chance! This, of course, is an overestimation; the cell-division concept employed is more applicable to microorganisms than to animals with blood-clotting cascades. In a more sober estimate, we may include into our reasoning the fact that only those changes that occur in germ cells are carried over to the next generation and thus are meaningful for evolution. Since males usually produce many more germ cells than females, we can leave the females out from the calculation. Assuming that a male produces 10^8 sperm cells in a year, a population of 10^9 individuals can carry out 10^{17} inheritable gene shufflings in a year. How many of these shuffling will actually be realized in an offspring depends on reproductive strategies and cycles in the species. If the average male produces only ten offspring a year, the population will carry out 10^{10} inheritable gene shufflings. The average time, in which a TPA molecule is expected to be formed by chance permutations of all the gene products within the germ cells of our population, is 10^8 years ($10^{18}/10^{10}$). This time is well within the bio- or geological time domain and significantly shorter than Behe's thousand billion (10^{12}) years. And if we did not limit ourselves to a single species, but considered the whole biosphere, the odds for producing TPA by chance would increase by several orders of magnitude. The numbers in our examples are arbitrary, but in contrast with those of Behe, they are more relevant to the real world of biology and, even more importantly, they are not demagogically misinterpreted.

Those colleagues, who undertake similar probabilistic calculations in the good faith that it is not a baseless and meaningless mathematical exercise, should not forget that the world contains more than just a single model animal and certainly more than just a single cell. This realization is even more important in the case of prebiotic evolution, where one deals with molecules instead of cells. Every high school kid knows that 1 liter of a 1 millimolar solution contains 6 x 10^{20} molecules which constantly collide and interact with each other with high frequency. The time scale relevant for molecular processes is typically between nanoseconds and seconds. The large number of particles and the high frequency of molecular interactions in every drop of the biosphere, whether in the cell or in a test tube, must be a part of any serious probabilistic considerations concerning Darwinian evolution.

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President's Column

"Before Your Ship Can Come In You Must First Send It Out"—Anonymous

There has been some debate about precisely when the new millennium started but I am reliably informed that we are now definitely in the 21st century and the new millennium has begun... As I think about the scientific achievements of the last century and how they changed the world as we know it, I find myself wondering what the new century will bring and how best to prepare our young people for the inevitable changes. The last century brought the splitting of the atom, flight to the moon, the discovery of the earth's templates, a biochemical description of previously unknown organisms, the eradication of diseases by antibiotics and vaccines, computers, radio and television, the mapping of the human genome and the creation of new life forms through genetic engineering. This was a truly remarkable legacy. Regretfully, it also brought the horror of scientific technology used in destructive ways: chemical dependency, bombs, gas warfare, germ warfare, and chemically induced famine to name but a few. So what will the new century bring and how do we prepare our young people for it?

I believe that we should impart to our young people three things: (1) the joy of discovery, (2) a sense of the awesomeness of nature, and (3) a belief in personal responsibility. As scientists, it is our privilege to share with our students opportunities for them to become involved in the search for new scientific knowledge and to share in the joy of science. There are new worlds to conquer and we can share our enthusiasm for discovery with our students. Our world is filled with marvelous flora and fauna whose incredible life cycles are always in evidence. It is replete with awesome monuments and incredible natural phenomena. A simple field trip could be the moment when a student stops saying "So what?" and starts saying "Wow!". The wow factor leads to a profound respect for the miracle of life and a sense of wonder at the awesome nature of the universe. This inevitably leads to the "what if?" questions. While we can not predict what the new century will bring in the way of scientific breakthroughs, it is obvious that there will be ethical decisions involving the acquisition, dissemination, and use of these scientific discoveries which must be faced by future generations. Preparing our students to make those ethical decisions is essential and it begins with an open discussion of controversial scientific choices ("if?, if not?" questions). Since scientific choices can have sweeping effects on our planet and possibly beyond, we have both a need and a duty as scientists to imbue our students with a sense of personal responsibility for choices made. In this fashion when we pass the torch to the scientists of tomorrow, they will be ready for it.

But how <u>do</u> we prepare our students in this era of rising costs, shrinking budgets, and larger class sizes? One approach is to network with other scientists and science educators at the meetings of the Mississippi Academy of Sciences (MAS) and Mississippi Junior Academy of Sciences (MJAS). Here you will meet your colleagues and fashion new approaches to old problems. Please bring your students to these meetings. The Academy meetings are a perfect way for a young investigator to present his/her research findings to a friendly and supportive audience and to attend symposia on topics of scientific importance. Interactions with faculty and other students will open a young person's mind to possibilities hitherto un-imagined. The meetings are also a place for teachers to make contacts with other educators. Many a useful collaboration has begun at the MAS and MJAS meetings. Similarly, the vendor's displays often have useful information about products which are appropriate for the classroom and teaching laboratories. Research scientists serve as mentors for students and new teachers. Get involved with the Academy and volunteer to serve on a committee. Not only does this help out the Academy, it is a great way to network. It is here that you learn from your peers how to shape scientific policy, design new educational strategies, and develop new scientific solutions. For as we enter the new century and new millennium the world is our bubble and Mississippi is our state. What we make of it determines the legacy that we will leave to our young people. How we accomplish our aims (scientific and other) defines who we are and serves as a beacon to others. But clearly, *before our ship can come in we must first send it out.* A very special thanks to Dr. Bill Lushbaugh and all the other volunteers who have helped make the Academy strong. It is my honor to serve you and I hope to see all of you at the next meeting.—Margot Hall

Executive Officer's Column

The fortunes of the Mississippi Academy of Sciences are clearly and closely tied to the activities of the colleges and universities in our state. While many MAS members work for state or federal government agencies, the large majority are college students and faculty members. It's no secret that Mississippi is struggling with financial problems due to the downturn in the economy. In turn this may have an adverse effect on the Academy since there will be less money available for traveling. On the other hand, financial cycles are nothing new to any of us. My Department's budget has been cut more than once in the recent past. In each case, at the next Annual Meeting, we had only a slight reduction in presentations and attendance. Apparently, when money is tight, many of us look to present our data in closer (read that as less expensive) venues. I would encourage our members to consider this again for the 2002 meeting in Biloxi.

Some years ago we asked for members to volunteer to help with aspects of the Academy. We had a reasonable response and that helped to bring some fresh ideas into the workings of our group. It's probably time again to request volunteers to help revitalize some of our viewpoints. If you would like to help with any detail of the MAS please contact me or one of the elected officers. We would love to have the benefit of new people serving on our committees. I have been reminding people that our seventy-fifth anniversary is approaching. If you have special ideas as to what the Academy can do then, please let us know.

This issue of our Journal has an article about the Journal itself. We are justifiably proud of the history of our Journal and its current configuration. As the article points out, we were one of the first Academy journals to have an online presence. The Journal is only a reflection of our membership. Again, in the spirit of volunteerism necessary for the MAS, if you have an article that you think might be interesting to our membership or beyond, please send it to our enthusiastic editor, Ken Curry. Ken does a superb job of husbanding our Journal, but he is always looking for more articles and cover pictures.—John Boyle

American Junior Academy of Sciences

What an exciting conference in San Francisco! AJAS delegates were astounded to be on the site when the actual scientific data from the Human Genome Project was published in Science. Our delegates were awed by Dr. Francis Collins' AAAS presentation. His meeting afterward in the student lounge for almost three hours will mark the turning point for science for numerous AJAS delegates.

For the first time, abstracts were submitted online. Although this process made filing easier, a number of student delegates thought that they were registering for the convention at the same time. Fortunately, Dr. Nelson (NAAS treasurer and housing director) was able to get these students housing. AJAS had 122 abstracts submitted electronically, with one abstract filed late. One hundred fourteen delegates representing 26 academies and 27 states presented their research work at this meeting. All abstracts will be published both electronically and in hard copy form in The 2001 NAAS Handbook, Proceedings and Directory.

The National AJAS Program Committee did a great job this year. This committee includes David Weaner (OH), Elemer Brenath (CO/WY), Don Cottingham (VA), Kathleen Donovan (OK), Barbara Gadegbeku (NJ), Edward Haynie (MO), Duane Nichols (CA), Tom Reeves (SC), Peg Tilgner (IA), and Ed Brogie (NE). The AJAS oral session moderators were Judith Williams (NE), Elemer Bernath (CO/WY), Barbara Gadegbeku (NJ), Tom Reeves (SC), Ed Brogie (NE), David Weaner (OH), Peg Tilgner (IA), Ginger Foley (SC), Lynn Brandvold (NM), Susan Booth (VA) and Susan Steward (VA). The bus coordinator was Kathleen Donovan (OK) with assistants Judith Williams (NE), Peg Tilgner (IA) and Peter Langley (OR). (This is Oregon's first year at AJAS!). A very special thanks goes out to the various AJAS committees for their help this year. Dean Decker does not plan to be back next year, as he is retiring. Charles Lytle (NC) and David Weaner (OH) will assist next year with photography and putting together the AJAS Official Scrapbook.

It is a great time to encourage students in each state to raise their funds for travel to AJAS/NAAS/AAAS conference in Boston. There are sample letters available that the state directors can send to the eligible student delegates. Mississippi's student delegation was increased from one to four in this manner. If you are interested in obtaining copies of these sample letters, please contact me by e-mail (joan.messer@jcjc.cc.ms.us).

Finally, AJAS extends its thanks to its sponsors: California Academy of Sciences, San Francisco State University, Forestry Suppliers, Inc., Lutron Electronics, Inc., & Pennsylvania Academy of Sciences.—Joan Messer

Divisional Report
Psychology and Behavioral Neuroscience

Mississippi Academy of Sciences Annual Meeting
February 2001

The Division of Psychology and Behavioral Neuroscience experienced a significant increase in participation at the annual meeting this year. More than a hundred requests for papers were distributed to psychologists and psychology graduate and undergraduate programs all over the state by the Division Chair, Pamela Banks. Fifteen research papers were presented in either slide presentations or poster presentations. The presentations scheduled for the morning session were well attended with standing room only in our meeting room. It was especially exciting to see the significant number of college students in attendance. For the first time in perhaps several years, two monetary awards were presented to students for outstanding research projects. The judges were professors from Jackson State University, University of Mississippi and Alcorn State University. In the category of Oral Paper Presentations, Jerome Burt, a doctoral student in Clinical Psychology at the University of Southern Mississippi, was given the "Outstanding Student Research Presentation Award." Mr. Burt presented a paper entitled, "Race receptivity and compromise." His research is supervised by Dr. Billy Barrios, University of Mississippi. In the category of Poster Presentations, Richisa Johnson, a senior psychology major at Jackson State University, was presented with the "Outstanding Student Poster Presentation Award." Her research topic was "Helpful and unhelpful comments to bereaved and non-bereaved individuals." Ms. Johnson is mentored by Dr. Pamela Banks, Jackson State University.

At the Divisional Business Meeting, it was decided that the Division of Psychology and Behavioral Neuroscience would combine with the Division of Social Science in order to enhance both divisions. The newly agreed upon name for the Division is the Division of Psychology and Social Sciences. Dr. Pamela Banks was selected to remain Chair of this division. Co-Chairs for the division will be Dr. Ann Marie Kinnell, University of Southern Mississippi and Dr. Billy Barrios, University of Mississippi. This year's divisional activities were regarded as very successful because of the participation of six of the state's institutions of higher learning. Faculty members and students from Alcorn State University, Delta State University, Jackson State University, University of Southern Mississippi, University of Mississippi and Tougaloo College participated in this year's annual session for the Division of Psychology and Behavioral Neuroscience.—Pamela Banks

MISSISSIPPI ACADEMY OF SCIENCES ABSTRACT FORM/MEMBERSHIP FORM

ABSTRACT INFORMATION

Abstract title______________________________

Name of presenting author(s)______________________________

(Presenter must be a current (i.e., 2002 membership dues must be paid) student member, regular member, or life member of the MAS)

Telephone____________________ Email____________________

Check the division in which you are presenting

__ Agriculture and Plant Science
__ Cellular, Molecular and Dev. Biology
__ Chemistry and Chemical Engineering
__ Geology and Geography
__ Health Sciences
__ History and Philosophy of Science
__ Math., Computer Sci. and Statistics
__ Marine and Atmospheric Sciences
__ Physics and Engineering
__ Psychology and Social Sciences
__ Science Education
__ Zoology and Entomology

Type of presentation

__ Poster presentation __ Workshop
__ Lecture presentation __ Invited symposium

*If the presenting author for this paper is also presenting in another division, please list the other division:*________________

Audio-visual equipment needs

__ 2" x 2" slide projector
__ Overhead projector

Other audio-visual equipment including computers and computer projection equipment must be provided by the speaker.

MEMBERSHIP INFORMATION

New__ Renewal__
Mr. Ms Dr.______________________________
Address______________________________
City, State, Zip______________________________
School or Firm______________________________
Telephone____________________ Email address____________________
PLEASE INDICATE DIVISION WITH WHICH YOU WISH TO BE AFFILIATED____________________

Regular member $25 Student member $5 Life member $ 250
Educational $150 Corporate Patron $1000 Corporate Donor $500

CHECKLIST

The following MUST be DONE:

__ 1. Enclose copy of abstract (even if abstract has been submitted electronically)
__ 2. Complete and enclose abstract form /membership form(this form)
__ 3. Enclose the following payments (make check payable to Mississippi Academy of Sciences):
  __ $25 per abstract
  __ $25 regular membership fee OR $5 student membership fee (2002 membership must be paid for abstract to be accepted)
__ 4. You must supply a check # __________ or P.O. # __________ (credit cards are not accepted)

In addition you MAY preregister at this time:

__ Enclose the following payments:
  __ $20 regular member (after 15 Jan.) ___ $12 regular member (Preregistration before Jan. 15, 2002)
  __ $10 student member (after 15 Jan.) ___ $ 5 student member (Preregistration before Jan. 15, 2002)
  __ $50 nonmember (after 15 Jan.) ___ $40 nonmember (Preregistration before Jan. 15, 2002)

NOTE: Late abstracts will be accepted with a $10 late fee and only if there is room in the appropriate division. They will be published in the April issue of the MAS JOURNAL.

MISSISSIPPI ACADEMY OF SCIENCES—ABSTRACT INSTRUCTIONS
PLEASE READ ALL INSTRUCTIONS BEFORE YOU SUBMIT YOUR ABSTRACT

< Your paper may be presented orally or as a poster. Oral presentations are generally 15 minutes although some divisions allow more time. The speaker should limit a 15 minute presentation to 10–12 minutes to allow time for discussion; longer presentations should be limited accordingly. Instructions for poster presentations are given on the reverse side of this sheet.

< Enclose a personal check, money order, institutional check, or purchase order for $25 publication charge for each abstract to be published, payable to the Mississippi Academy of Sciences. The publication charge will be refunded if the abstract is not accepted.

< The presenting author must be a member of the Academy at the time the paper/poster is presented. Payment for membership of the presenting author must accompany the abstract.

< Attendance and participation at all sessions requires payment of registration.

< Note that three separate fees are associated with submitting and presenting a paper at the annual meeting of the Mississippi Academy of Sciences. (1) An abstract fee is assessed to defray the cost of publishing abstracts and (2) a membership fee is assessed to defray the costs of running the Academy. (3) Preregistration payment ($12 regular; $5 student) may accompany the abstract, or you may elect to pay this fee before January 15th, or pay full registration fees at the meeting.

< Abstracts may be submitted by e-mail or entered directly through the MAS website. The URL is http://www.msacad.org. This abstract submission form and the appropriate fees should be sent by US mail even if the abstract has been submitted electronically.

< Abstracts may be submitted as a WordPerfect, Word, ASCII, ANSI, or .RTF file on a PC readable diskette. *Formatting should be minimal*. This abstract submission form and the appropriate fees should be sent by US mail even if a diskette is used for the abstract.

< Abstracts may be submitted typed or printed on clean white paper. Abstracts received in this form will be scanned into a computer. Leave ample margins and use a sanserif type font to help minimize errors in scanning.

< Submit your abstract and appropriate fees to the Abstracts' Editor, John Boyle, TO BE RECEIVED NO LATER THAN NOVEMBER 1, 2001.

< Late abstracts will be accepted with a $10 late fee and only if there is room in the appropriate division. They will be published in the April issue of the MAS journal.

Dr. John Boyle
Mississippi State University
Dept. of Biochemistry
P.O. Drawer 9650
Mississippi State, MS 39762

FORMAT FOR ABSTRACT

< Your abstract should be informative, containing: (a) a sentence statement of the study's specific objectives, unless this is given in the title; (b) brief statement of methods, if pertinent; (c) summary of the results obtained; (d) statement of the conclusions. It is not satisfactory to state, "The results will be discussed."

< Your abstract, including a concise, descriptive title, author(s), location where work was done, text and acknowledgment, may not exceed 250 words. *Excessively long abstracts will be truncated.*

< The title should be all capital letters. Use significant words descriptive of subject content.

< Authors' names start a new line.

< The institution where your research was done should include city, state, and zip code. Do not include institutional subdivisions such as department.

< The abstract should be one paragraph, single spaced, starting with a 3-space indentation.

< Use standard abbreviations for common units of measure. Other words to be abbreviated, such as chemical names, should be spelled out in full for the first use, followed by the abbreviation in parenthesis. Do not abbreviate in the abstract title.

< Special symbols not on your printer or typewriter must be in black ink.

< Use italics for scientific names of organisms.

< Begin authors' names on a new line. Place an asterisk (*) after the presenter(s), if there are multiple authors.

< Use superscripts for institutional affiliations where necessary to avoid ambiguity.

< Refer to these examples as guides.

EXAMPLES OF TITLES AND AUTHORS:

[single author, no ambiguity about designated speaker or affiliation]
AN EXPERIMENTAL MODEL FOR CHEMOTHERAPY ON DORMANT TUBERCULOUS INFECTION WITH PARTICULAR REFERENCE TO RIFAMPICIN
Joe E. Jones, Mississippi State University, Mississippi State, MS 39762
Abstract body starts here . . .

[two authors, both designated as speakers, different affiliations, but no ambiguity]
AN EXPERIMENTAL MODEL FOR CHEMOTHERAPY ON DORMANT TUBERCULOUS INFECTION WITH PARTICULAR REFERENCE TO RIFAMPICIN
Joe E. Jones* and Ralph A. Smith*, Mississippi State University, Mississippi State, MS 39762 and University of Mississippi Medical Center, Jackson, MS 39216
Abstract body starts here . . .

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Abstract body starts here . . .

GUIDELINES FOR POSTER PRESENTATIONS

< The Academy provides poster backboards. Each backboard is 34" high by 5' wide. Mount the poster on the board assigned to you by your Division Chairperson. Please do not draw, write, or use adhesive material on the boards. You must provide your own thumb tacks.

< Lettering for your poster title should be at least 1" high and follow the format for your abstract. Lettering for your poster text should be at least 3/8" high.

< Posters should be on display during the entire day during which their divisional poster session is scheduled. They must be removed at the end of that day.

< Authors must be present with their poster to discuss their work at the time indicated in the program.