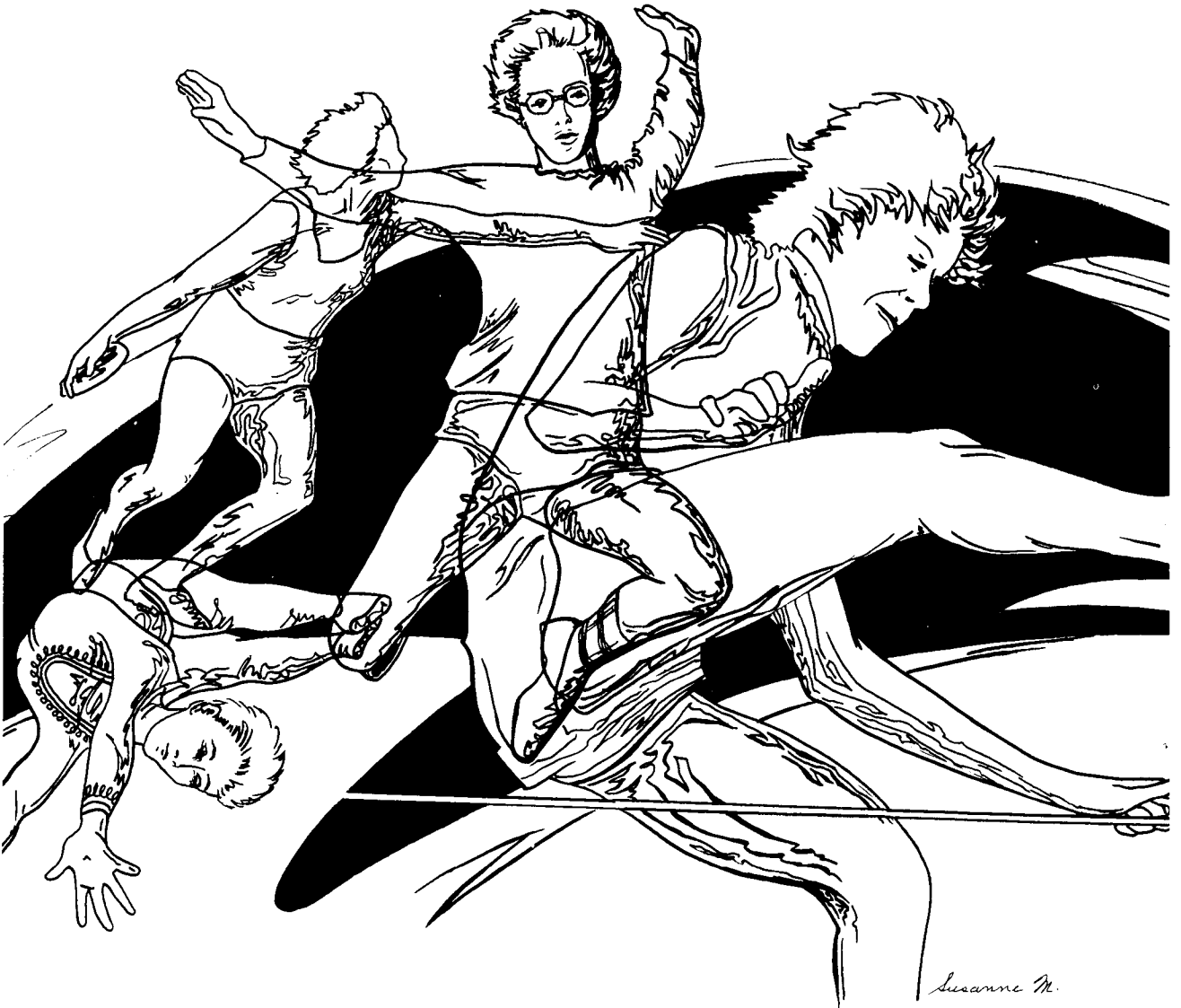


Women's Athletic Potential

by Sally Luce



What are the effects of exercise and, more specifically, participation in athletics on women and girls? This question is rarely raised without empty rhetoric and arm-waving substituted for empirical evidence and logical thinking, particularly when comparisons between the sexes are involved. Perhaps this is because sport, especially sport involving strength and endurance, is one of the last bastions of male dominance in the fading mythology of male supremacy in other aspects of our economic, cultural and social life.(1) Many feminists who assert that full equality of opportunity in other spheres would lead to the equally skillful participation of women are reluctant to make a similar claim for athletics. Athletics, of course, includes a wide variety of activities from figure skating and long distance running to weight-lifting and ice hockey. While some feminists might more readily entertain the notion that a few women could achieve prominence in a small number of athletic events when competing with men, most would not risk the criticism of their colleagues and the derision of those less sympathetic to their cause by taking the more extreme position that women, given the opportunity to develop fully their athletic abilities, might someday compete on a par with men in most, if not all, athletic events.(2)

This possibility will, nevertheless, be considered seriously here. Of course, hypotheses about the potential physio-

logical inequality or equality of the sexes with regard to exercise, training and sports cannot be accepted at this time. Adequate comparisons of girls to boys and women to men in athletics cannot be made because of the tenacious and pervasive attitudes in most cultures that it is inappropriate for females to become athletes. Also, even when girls and women are foolhardy enough to become athletes despite the prevalent attitudes about the impropriety of their athletic interests, they are further handicapped by poorer training opportunities, poorer coaching, fewer extrinsic rewards for excellence and the belief that they can never be as good as most male athletes. Since these limitations make accurate comparisons of the sexes impossible, two different but related aspects will be discussed: world athletic records of women and men and the research on women's response to exercise and training. Both of these areas will be examined to assess the future possibility of equality of athletic performance of the sexes.

As the introductory remarks implied, the general inferiority of women's athletic skills is taken as a fact in most cultures. Moreover, the statistics often cited to prove this "fact" are world records for athletic events--primarily those for track, field and swimming--in which men's records are shown to be better than women's in every comparable event.(3) This approach was taken by Catherine Cox Miles in 1935 when she

did an extensive review of the scientific literature on sex differences.(4) To compare the muscular potential and strength of the two sexes, she examined the 1934 World Almanac for women's and men's world records. Miles' observations and conclusions are presented here because they provide examples of the type of reasoning about women's potential which can be reexamined in light of more recent world records.

Miles noted several things from her examinations of world records and her general observations of the athletic interests of both sexes. First, women participated in fewer athletic events than men. Second, men's records were better in every event in which both sexes participated. Third, the percentage difference in the women's and men's world records increased as the distance of running or swimming increased. In other words, although women's records were consistently poorer, their records were poorer still in comparison to men's for the longer distance swimming and running events which presumably require greater strength and endurance. Miles admitted that women and men did not share a similar interest in these particular athletic events, but she nevertheless cited her three observations as evidence for men's greater muscular potential.

Of all Miles' observations and conclusions, the least relevant to a comparison of women's and men's athletic po-

tential is the notion that women participate in fewer athletic events than men. The usual implication of such "evidence" is that women do not participate in as many events as men because they are not as interested, and they are not as interested because they are generally not as capable. This reasoning does not take into account the fact that women, in spite of their poorer world records to date, do participate in a wide variety of sports. It would be an enormous undertaking to consider all the reasons why (or perhaps more appropriately if) women do not participate in certain sports, but this issue might be more clearly understood by examining the problems of women who do participate in sports thought solely to be in the male domain. Problems encountered by women long distance runners will be outlined below as a case in point. Doubtless there are problems and issues unique to this type of event as there would be with any other, but this example should serve to illustrate some of the barriers women athletes face.

In the first place, Miles' personal observations and the 1934 World Almanac were not impeccable sources for lists of athletic activities in which women participate. The 1974 World Almanac, for example, did not list women's world records for events longer than 3000 metres although women, in fact, have set records for distances as long as 50 miles.(5) It is difficult to pinpoint all the reasons why women's records in

long distance running receive so little notice, but a major one may be that countries can better enhance their prestige by supporting financially and morally those athletes whose events are held in such high profile meets as the Olympic Games. There are fewer events of all types for women in the Olympics, and this is equally true for running. The two longest individual running events for men are the 10,000 meter race and the marathon, a race of 26 miles, 385 yards, held since 1912 and 1896 respectively, as compared to the 800 metre and 1500 metre races for women held since 1928 and 1972 respectively. If women's events are not equivalent to men's in the high status meets like the Olympics, it is not surprising that members of the general public assume the events are omitted because women do not usually participate in such events. Further, most countries are hard-pressed to support their athletes whose events are held in the Olympics; so women whose events are not part of the Olympics or other similar games receive little or no government notice or support to assist them in their training.

This discussion so far has focused on the problem of women distance runners being ignored and neglected, but there is at least one instance in Canada in 1976 of active discouragement, if not discrimination, against women distance runners. Here is an excerpt from an article by Eleanor Thomas, a marathon

runner from Ottawa, who describes the barriers she met when attempting to enter the 15 mile annual 'Round the Bay Race' in Hamilton, Ontario:

Unfortunately the route is not the only race tradition . . . that dates from the days of the horse and buggy. When asked about awards in the Open Masters and Women's categories, Mr. Knox responded, "We do not encourage women to enter this race." Why not? "We are not interested in women! I feel--the committee feels--that if women want to run in this kind of race, well let people run races for women." (6)

Thomas continued by citing two reasons given by Knox, the secretary of the race committee, for discouraging women: tradition and the two and one-half hour time limit. (The time limit, incidentally, would have been no barrier to Thomas or to many other Canadian women distance runners.) Although Knox mentioned that, in the previous year and several times in other years, a woman had entered the race, he cited the lack of women's participation as yet another reason for not having a women's category. Thomas commented further:

He stated that if a block of women sent in entry forms the committee might reconsider its policy, ". . . but this has never happened." Hardly surprising, since last year (and probably in all previous years though this is not

known for sure) the entry form clearly stated men only. (7)

In many ways, the plight of women long distance runners, and doubtless many other women athletes as well, would appear to be a classic and vicious double bind: because they are ignored and discouraged, they participate in fewer long distance events and in smaller numbers than men, but because they participate less frequently and in smaller numbers, they are discouraged from participating. Fortunately, the discouragement has not been so strong as to totally prevent women from running in competitions; hence, women, though little noticed, have set records for distances of 50 miles. Therefore women's lack of participation in certain athletic events should not be interpreted as evidence for men's muscular superiority. This sort of interpretation is, at best, gross ignorance of the little-noticed accomplishments of women athletes, and, at worst, a further and unnecessary discouragement for women athletes.

It is appropriate at this point to consider the evidence available from women's world records in 1974--forty years since Miles' pronouncements--relating to women's athletic potential.

Miles' second observation was that women's world records were poorer than men's. While this was true in 1934 and again in 1974, it does not necessarily

follow that men generally have a greater athletic potential than women. The average athletic or muscular potential of girls and boys, women and men can only be determined from a general population survey of people who, for the most part, are not athletes. World class athletes form too select a group to make any general statement about sex differences in athletic capabilities. World records are, nevertheless, inherently interesting to the athlete and non-athlete alike because they do represent the known maximal performances of human beings in certain types of competitive situations. Keeping in mind what world records do and do not represent, it is interesting to examine the world records of women and men in 1974. Some of the 1934 and 1974 records are shown in Table 1. (8) Several aspects of these data are notable. First, the percentage difference of women's and men's records in all but one case has decreased since 1934, indicating a greater degree of improvement in women's records than men's records over the forty-year period. Second, and perhaps more noteworthy, women's 1974 swimming records are better than men's 1934 records for all events except the 100 metre freestyle where the women's record is only .14 seconds slower. The women's 1974 shot put and discus records are also better than men's 1934 records, but the listing of the records did not indicate whether the records were based on equivalent weights of shot and discus.

The more recent women's swimming records, though not the running records, contradict Miles' third observation that the percentage differences become larger with longer distance events. Indeed, the percentage differences of women's and men's swimming records for 1974 are somewhat smaller at longer distances and somewhat larger at shorter distances while the reverse is true for running events.(9) These relations can also be expressed as correlations. The correlation coefficient for the swimming events is negative ($r = -.64$) and statistically significantly different from zero (less than 1% likelihood that this correlation would have occurred by chance). The correlation coefficient for the running events is positive ($r = .55$) and also statistically significant (less than 3% likelihood that this correlation would have occurred by chance). It was never proper to infer men's greater muscular potential in general from their relatively better world records at longer distance running and swimming races. Even if Miles' interpretation of the data had been restricted to a prediction of future world record trends, the 1974 trends in world and Olympic records for swimming would belie the prediction.

While there is no direct indication from the world records for 1974 that women's best competitive performances will equal men's, there is certainly an indirect indication in the remarkable improvement in women's world records over the past

forty years despite the many obstacles that most women athletes have had to overcome that male athletes do not ordinarily face. When all girls are encouraged to be as active as their brothers in athletics and when, as athletes, girls and women receive the same encouragement that boys and men now receive, it would be more likely that women with the best athletic potential would be identified early and given proper training. This situation could only enhance both the possibility that women would continue to break their world records at a greater rate than men do and the possibility of women's world records equalling men's. World records, then, can be used to describe the maximal attainments of women, but they cannot be used as an indication of the average woman's potential in exercise, training and sport. This more general question will be discussed below.

Research on exercise physiology reflects, as does most other research, its cultural bias. Therefore, it is not surprising that much more research has been devoted to the exercise physiology of the human male than the human female although little enough is known about the former. Drinkwater in 1973 noted this dearth of research when she reviewed the literature on the physiological responses of women to exercise.(10) Before considering the research findings, however, it is necessary to describe the methodological limitations of the research which has been conducted

and to describe briefly the means of and rationale behind the measurement of responses to exercise and training. There are some methodological issues relating to the social psychology of the experiments that exercise physiologists have paid little attention to as well as the problems specific to research on exercise. Both sets of problems will be outlined below.

A few years ago Robert Rosenthal brought the concept of the expectancy effect to the attention of psychologists through a series of experiments in which he demonstrated that the experimenters' expectation about the outcome of the research could dramatically influence the experimental results in favour of the expected outcomes when both human and animal subjects were used.(11) Ideally, such biases may be eliminated by using a "double blind" experiment in which neither the subject nor the experimenter knows which of several randomly assigned treatments the subject is receiving. Research on sex differences, however, is not amenable to the double blind technique because a subject's sex cannot readily be disguised and because expectancies about sex differences are part of every experimenters' and subjects' socialization and day to day experience. Further, the ethical considerations in research on humans generally require the informed consent of the subjects. Hence, the ethical experimenter must describe the experimental procedures to be used and the risks, if any, which are involved and

finally obtain the subject's voluntary consent to remain in the experiment. While the ethical requirements do not include a revelation of the expected outcome of the research, this procedure does increase the likelihood that well-informed subjects may be able to guess the experimental hypotheses. Research on the social psychology of the experiment has shown that subjects, especially volunteers, try to be "good subjects" and will attempt to behave in accordance with the experimental hypotheses, if known or deduced, even if this is contrary to what their unbiased behaviour would be.(12) These factors are not as likely to interfere with the measurements involving physical standards such as body weight or serum hemoglobin as are the amount of effort a subject will put into an exercise or training program and any self-reports pertaining to the experimental procedures given by the subject.

In addition to these difficulties, there are problems within the exercise physiology paradigm which Drinkwater summarized:

Two major problems in determining if there is a response mediated by the factor of sex are the lack of a standard method for presenting the data and the variation in experimental design from one study to the next.(13)

In part, according to Drinkwater, the methodological problems are aggravated by the inappropriate use of statistical tests in which small, but not statis-

tically significant, differences between the sexes are treated as if they are significant. The other methodological issues referred to by Drinkwater are best illustrated by a description of the measurements exercise physiologists use and the findings, based on these measurements, regarding women's response to exercise and training.

Exercise physiologists do not use general terms such as athletic potential or muscular potential when they describe the effectiveness of an individual's response to exercise. Instead, they rely on the measurement of maximal oxygen uptake. This is calculated by having subjects run on a treadmill or operate a stationary bicycle at a fairly strenuous pace. As the subjects exercise, they breathe into a device which measures the amount of oxygen used per minute. Oxygen uptake is then usually expressed relative to overall body weight or to lean muscle mass, the estimated weight of the individual's muscle tissue. This allows correction for the fact that larger individuals generally have greater lung capacity, blood volume and larger hearts but also larger bodies to move when they exercise. The oxygen uptake measurement is important because the greater the amount of oxygen delivered to the muscles, the greater the body's capacity is for burning stored fuel and, hence, for doing work. Simply put, the ability to move oxygen to the muscle tissues is a reflection of the

efficiency of the cardiovascular system; i.e., the heart's ability to pump freshly oxygenated blood to the tissues and oxygen-depleted blood back again to the lungs.

Drinkwater's review(14) indicated that men, on the average, have greater oxygen uptake than women although there is considerable overlap in this ability. Women athletes, on the average, have been shown to have considerably higher average oxygen uptake than either the average woman or man although their uptake is less than the average for male athletes. Women are penalized when oxygen uptake is measured relative to overall body weight because their bodies, on the average, have a higher fat composition than men's. Since it is only the muscle tissue that is involved in exercise, however, some researchers measure oxygen uptake relative to the body's estimated lean muscle mass. There are, incidentally, several ways of estimating lean muscle mass, and the researchers disagree as to which measure is most appropriate. Using some measure of lean muscle mass, researchers have variously found women and men as having higher oxygen uptake, and in some cases no sex difference. The methodological problems in the research in this area should now be apparent. There is a basic disagreement as to the way to best express an individual's oxygen uptake although most would agree that some measure of oxygen uptake is the best indication of a person's response to exercise.

There are some absolute limits on any person's ability to process oxygen, but girls and women who are not already highly trained athletes have been able to increase their oxygen uptake and cardiovascular efficiency significantly through programs of exercise and training. Little research has been done on the relative effects of age and environmental stressors (e.g. altitude, heat, cold) on women's physiological response to exercise, but hopefully further research will also shed new light on these questions. In her review, Drinkwater stated:

. . . enough contradictions are already apparent in the literature to make it difficult, if not impossible to generalize about the female's response to physical activity. . . . Still unresolved is the basic question of the extent to which the factor of sex mediates the physiological response to exercise. . . . Is the woman limited in her maximal aerobic power by her cardiovascular system or are the quantitative differences in the maximal oxygen uptake between the sexes merely a function of how the data are reported?(15)

If the researchers can come to an agreement about the appropriate way to express an individual's oxygen uptake, and even if their method of choice suggests that women, on the average, have a lower oxygen uptake than men, the question still remains of whether this difference is a

biological sex limitation or a cultural limitation imposed by proscriptions on high levels of physical activity for girls and women. Girls and women in North America typically are more sedentary than boys and men, and this fact alone may account for the sex differences if they are found. For the most part, the true nature of women's response to exercise, training and participation in athletics is currently more in the realm of speculation than in the realm of incontrovertible fact.

Because women can benefit from exercise, training and participation in sport, there should be the same opportunities for girls and women to be athletes as boys and men now enjoy. Given the handicaps of poorer coaching, poorer training facilities, little encouragement, little recognition and even overt discrimination, women athletes have made remarkable gains in setting new world records at a greater degree of improvement than men over the period from 1934-1974. With the demise of sex-role stereotypes that prevail against girls and women enjoying sports and developing themselves physically, the measures of the athletic potentials of average males and females should reflect the greater level of fitness which girls and women enjoy. As well, the breaking of women's world records should continue at a greater rate of change than men's given a larger pool of potential world class women athletes from which to select. Whether these predicted improve-

ments will result in the eventual equality of the sexes in athletics remains to be seen. However, the evidence does not deny this possibility. Perhaps the proposed social changes that would improve women's opportunities for becoming athletes would also reduce the necessity of women athletes having to prove their worth by equalling men or excelling in those events which men have defined as worthwhile.

TABLE 1

WORLD RECORD COMPARISONS FOR WOMEN AND MEN
1934 and 1974

Event	Women's Record		Men's Record		Differences (%)	
	1934	1974	1934	1974	1934	1974
100 m Run	11.9	10.8	10.3	9.9	16	9
200 m Run	24.1	22.1	20.6	19.5	17	13
800 m Run	2:16.8	1:58.3	1:49.8	1:43.7	24	14
400 m Relay Run	46.9	42.8	40.0	38.2	17	12
800 m Relay Run	1:45.8	1:33.8	1:25.2	1:21.5	23	15
High Jump	1.65 m	1.94 m	2.04 m	2.30 m	19	15
Long Jump	5.98 m	6.28 m	7.98 m	8.90 m	25	23
Shot Put	13.70 m	21.03 m	15.43 m	21.82 m	11	4
Discus	42.43 m	67.44 m	51.73 m	70.04 m	18	4
Javelin	44.64 m	62.40 m	74.02 m	94.08 m	40	34
100 m Freestyle	1:06.6	57.54	57.4	51.22	16	12
200 m Freestyle	2:43.6	2:03.56	2:08.8	1:52.78	21	10
400 m Freestyle	5:28.5	4:18.07	4:47.0	3:58.18	14	8
800 m Freestyle	12:18.6	8:52.97	10:15.6	8:17.60	20	7
1500 m Freestyle	23:17.2	16:54.14	19:07.2	15:31.85	22	9
100 m Breaststroke	1:26.0	1:13.58	1:13.6	1:04.02	17	15
200 m Breaststroke	3:03.4	2:38.50	2:44.6	2:19.28	11	14

NOTES

1. In this paper, the terms sport and athletics will be used interchangeably.
2. The assumption is made here that women and girls would, at this future point in time, actually desire to participate in all the sports in which men now participate.
3. There are a number of athletic events where world records do not exist such as basketball, tennis, ice and field hockey, figure skating, fencing, etc., where comparisons between the best women and men athletes are not as readily made. It will be interesting to note whether these sports that do not readily allow comparisons between the top athletes of both sexes will be the sports where the sex barriers are maintained the longest.
4. Catherine Cox Miles, "Sex in Social Psychology," in C.A. Murchison, (ed.), A Handbook of Social Psychology. Vol. 2. (New York: Russell & Russell, 1935).
5. G.E. Delury, (ed.), The World Almanac and Book of Facts, 1974 Edition. (New York: Newspaper Enterprise Association, 1973). This sourcebook, though not entirely adequate, was used for the comparisons to Miles' 1934 World Almanac data, as a forty-year time marker. The women's world record for the fifty mile run was noted in Jack H. Wilmore and C. Harmon Brown, "Physiological Profiles of Women Distance Runners," in Medicine and Science in Sports. Vol. 6, No. 3, 178-181, 1974. This record was 7:05:31 at the time the article was submitted for publication.
6. Eleanor Thomas, "Round the Bay in Hamilton," On the Run/En Courant; The Newsletter of the National Capital Runners' Association (Ottawa: March, 1976), pp. 4-5.
7. Ibid.
8. The source for the 1974 records was G.E. Delury, op. cit. The percentage difference in the records is calculated by dividing the absolute difference in the records by the best record and then multiplying by 100. Miles' list of records included events that apparently have either been discontinued or have become less popular such as running and swimming events in the 300-900 metre range. Similarly, the 1974 records indicated many more events for both sexes of longer distances than Miles cited. Women's records for the mile and the 3000 metre run, for example, were given in the 1974 listing, but not in the 1934 listing. The records shown in Table 1 are all those from 1934 and 1974 which were available for comparable events.
9. Both world and Olympic records for running and swimming events were used for the 1974 calculations to increase the number of data points so that a correlation coefficient, a statistical description of the degree of relationship, between the percentage differences and distances could be calculated and tested for both running and swimming events. In the case of the running events, in particular, observations for distances longer than those Miles used were available.
10. Barbara L. Drinkwater, "Physiological Responses of Women to Exercise," in Jack H. Wilmore (ed.), Exercise and Sport Sciences Reviews, Vol. 1, 1973, pp. 125-153.
11. Robert Rosenthal, Experimenter Effects in Behavioral Research (New York: Appleton-Century-Crofts, 1966).
12. Ibid.
13. Drinkwater, op. cit.
14. Ibid.
15. Ibid.