
UNIVERSITY OF KANSAS PUBLICATIONS
MUSEUM OF NATURAL HISTORY

Vol. 10, No. 8, pp. 573-585
October 8, 1959

**Natural History of the Salamander, *Aneides
hardii***

BY

RICHARD F. JOHNSTON AND GERHARD A. SCHAD

UNIVERSITY OF KANSAS
LAWRENCE
1959

Editors: E. Raymond Hall, Chairman, Henry S. Fitch,
Robert W. Wilson

Volume 10, No. 8, pp. 573-585
Published October 8, 1959

UNIVERSITY OF KANSAS
Lawrence, Kansas

PRINTED IN
THE STATE PRINTING PLANT
TOPEKA, KANSAS
1959

27-9040

[Pg 575]

**Natural History of the Salamander,
*Aneides hardii***

BY

RICHARD F. JOHNSTON AND GERHARD A. SCHAD

The Sacramento Mountains Salamander, *Aneides hardii* (Taylor), is a plethodontid of relict distribution in the spruce-fir vegetational formation from 8500 to 9600 feet elevation in Otero and Lincoln counties, New Mexico. The salamanders on which most of this report is based were collected three, four, and six miles northeast of Cloudcroft in the Sacramento Mountains. Additional individuals were collected on the eastern slope of Sierra Blanca, 1.5 miles southwest of Monjeau Lookout, at about 9000 feet, Lincoln County, and in the vicinity of Summit Springs and Koprian Springs, 9300 feet, Capitan Mountains, Lincoln County. Certain details concerning the populations in Lincoln County will be reported elsewhere (Schad, Stewart, and Harrington, Canadian Jour. Zool., in press).

We would like to thank Mmes. Donna Schad and Lora Lee Johnston, Messrs. Robert Stewart, Frederick Harrington and Ralph Raitt, and Dr. Robert Selander for assistance in the field, Dr. W. Frank Blair and Dr. Marlowe Anderson for the use of specimens in their care, and Dr. A. Byron Leonard for the identification of the molluscan food items.

In the summer rainy season *A. hardii* lives in and under downed timber and under talus accumulations. Occurrence, however, seems to be partly subterranean and always local; seemingly good habitat frequently appears to lack the animals. Our observations and collections were made in July, August, and September in 1956, 1957, and 1958. Two hundred seventy-seven individuals were taken; these were measured, sexed and examined for breeding status. The food and parasite content of the guts of a few individuals was determined. Thirteen salamanders were kept for varying lengths of time in captivity. The specimens are now stored in collections at New Mexico State University, University of Texas, Museum of Vertebrate Zoology, and the Museum of Natural History, University of Kansas.

The primary study and collecting sites were four and six miles northeast of Cloudcroft, Otero County, at 8600 to 8800 feet in elevation.[Pg 576] Vegetation was either almost pure stands of Englemann spruce (*Picea englemanni*) or mixed stands of spruce, Douglas fir (*Pseudotsuga taxifolia*) and white fir (*Abies* sp.). At each locality small oaks (*Quercus*) were present among the dominant conifers. Most of the salamanders found were in downed Douglas fir logs; some were taken from spruce and others from cracks in a variety of deadwood. In the less deteriorated logs the salamanders lived under the loose bark or in small cracks and chambers near the inner bark surface. In large fir logs in advanced stages of decomposition, salamanders could be found to the very centers. This kind of log was apparently highly favorable for salamanders, for it was in such sites that we found notably large numbers of the animals and most of the clutches of eggs that we collected; this kind of log is not frequently found, for its wood is saturated with water and completely punky and nearly ready for final collapse.

In winter, salamanders that spent the summer at the surface presumably move to subterranean cavities, or, at least, to sites away from winter freezing. In December,

1957, and April, 1958, four feet of snow covered our collecting sites, and the downed logs contained ice. A few logs were wet at the surfaces where sunlight hit them, but just under such melt they were icy. On May 3, 1958, snow was in isolated drifts and the centers of the logs were still icy. On May 31, and June 22, 1958, there was no ice anywhere, but no salamanders were evident. Late June is, however, around the earliest time that *A. hardii* emerges (Taylor, 1941).

Food and Foraging Behavior

We identified the contents of stomachs from 16 salamanders collected in 1956 and 1957; the items found in them are listed in Table 1. It is not likely that this list is complete for prey species because *A. hardii* eats a variety of food and probably takes prey almost indiscriminately if it is of appropriate size. The kind of food most frequently eaten was ants; they comprised almost 40 per cent of the total items. Nevertheless, less than half the stomachs contained ants; this may mean that salamanders do not make an effort to take ants over any other prey. Such foraging behavior would result in random capture of ants, and it is noteworthy that the frequency distribution of ants in stomachs suggests a Poisson distribution, a mathematical description of one kind of random distribution.

TABLE 1.—NUMBERS OF FOOD ITEMS FOUND IN STOMACHS OF 16 SPECIMENS OF ANEIDES HARDII

ITEMS	Individual animals	Percentage of total (154) individuals	Number of stomachs in which found
Mollusca			
<i>Pupilla muscorum</i>	}	1.9%	}
<i>Gastrocapta</i> sp.			
<i>Vallonia pulchella?</i>	4	2.5	
Arthropoda			
Arachnoida			
Arachnida	15	9.7	9

Acarina	13	8.4	3
Insecta			
Orthoptera (<i>Ceuthophilus</i>)	2	1.3	2
Hemiptera	1	0.6	1
Coleoptera			
adults (carabids and buprestids)	8	30.9	7
larvae	38		
Hymenoptera			
ants	62	40.2	7
wasps	2	1.3	2
Unidentified	5	3.2	5
Total	154	100.0	

Adult and larval beetles comprised about 28 per cent of the total items, but were found in only seven of the stomachs. Beetles [Pg 577] eaten were small representatives of beetle groups likely to occur in or under logs. A relatively large species of spider was found in nine stomachs; it represented only ten per cent of the items taken but was one of the most important foods when mass is considered.

Two adult salamanders not included in Table 1 were found, in the course of examination for parasites, to have empty stomachs. One was a male, and the other was a female taken from a chamber that held an egg cluster. It would not be surprising regularly to find stomachs empty in "incubating" females, but the fact is that the one other such female collected by us had a small amount of food in the gut; probably these individuals take anything that enters the egg chamber, but do not leave for active pursuit of food.

Foraging behavior of captive salamanders was observed by one of us. The salamanders were maintained in a seven-gallon aquarium, the floor of which was covered with soil, mosses, liverworts, certain flowering plants, and pieces of rotten fir log. The

salamanders were placed in the terrarium in September, 1956, July, 1957, and October, 1958; one individual lived 13 months, another 14 months.[Pg 578]

A variety of natural foods was present in the soil and plant matter placed in the terrarium, and these were presumably eaten as found by the salamanders. However, the great bulk of the food used by the salamanders was introduced for them, in the form of colonies of *Drosophila melanogaster* in half-pint milk bottles. We tried to keep thriving colonies of flies, primarily of the mutant vestigial-winged type, present in the terrarium; in 1957 this was successful to the extent that there appeared to be a surplus of food available at all times. We did not attempt to feed the salamanders any wholly artificial food, such as ground beef.

Initially, the salamanders, although seemingly healthy and well-fed, were not fat. Those that we maintained on a presumably minimal diet remained slender and did not grow in length. Two individuals captured in 1957, however, were maintained on food in excess, and these grew in length and in girth; from an initial size of about 37 mm. snout-vent length (a subadult size) they attained about 45 mm. snout-vent length (an adult size) in a period of five months. The observations on foraging behavior were made primarily on these latter individuals.

The salamanders captured prey by pursuit. A salamander would pursue a fly until it was caught, or until it moved out of the field of action. The salamanders were attracted by movements of flies, and ignored those that were completely quiet; predation was oriented almost wholly on a visual basis. Once they were within 2 to 4 mm. of a fly they would snap out the tongue to secure the fly; they were successful in capturing vestigial-winged flies in about 75 per cent of all tries. The relative success of capture was greater when the animals were fresh from the field and less after they had become fattened. The vigor of their pursuit also decreased noticeably once they became fat. About two days after any new fly colony was placed in the terrarium, a salamander would take up a position just inside the lip of the milk bottle, which was placed on its side. From this vantage point the salamanders took heavy toll of the fly populations, eating both adults and larvae.

Initially the salamanders foraged indiscriminately in daylight or in darkness. Later, as they became fat, they avoided high light intensity and were active only at night or under artificial light of low intensity. The latter pattern of activity is probably typical of the pattern they maintain under natural conditions. Certainly we never saw individuals abroad in daylight at Cloudcroft, yet under favorable environmental conditions they were to be found in sites[Pg 579] that required considerable movement over open areas of the ground surface.

For several months two individuals of *Eurycea longicauda* were kept in with *A. hardii*. Foraging of these two plethodontids is nearly identical, but the tongue of an

adult *Eurycea* can be extended somewhat more than one-half inch in capturing flies; for *A. hardii* this distance is usually less than one-quarter inch. The relatively short tongue of *A. hardii* can be correlated with its life in restricted, subsurface chambers, where prey most frequently is close to salamanders; *E. longicauda* inhabits significantly more open sites.

Parasites

Thirty of the adult *Aneides* collected were examined for parasites; most were parasitized by two species of nematodes, *Oswaldocruzia* sp. and *Thelandros* sp. The former is found in the anterior part of the small intestine and occasionally in the stomach, and the latter occurs in the rectum. There were no gross intestinal pathological changes in the salamanders resulting from parasitism. In fact, no pathological or structural abnormalities were noted in any of the salamanders examined. We believe the two nematodes are well-tolerated by the salamander.

TABLE 2.—OCCURRENCE OF PARASITIC NEMATODES IN ANEIDES HARDII

	Per cent of salamanders infected	Number of nematodes per host		Per cent of nematodes that were immature	
		range	mean	July	Aug.-Sept.
<i>Oswaldocruzia</i> sp.	83	2-15	3.6	100	20
<i>Thelandros</i> sp.	90	1-17	3.3	64.6	5.7

The numerical and temporal occurrence of the nematodes is summarized in Table 2. It should be noted that of the 17 worms constituting the maximum infection by *Thelandros*, only one was an adult worm; the maximum number of adult *Thelandros* in any one host was five. Similarly, the heaviest *Oswaldocruzia* infection, 15 worms, consisted of immature individuals; the maximum number of adult worms in any one host was ten.

The monthly variation in the relative occurrence of young stages *versus* adult in both nematodes (Table 2) suggests that the parasites [Pg 580] are eliminated from hosts sometime in the long period, late September to early June, when *A. hardii* exists subterraneously; the worms thus would be reacquired annually when the salamanders resumed living on the "surface" or near the surface. Table 2 shows that the majority of the worms are immature (100 per cent, in *Oswaldocruzia*) in samples taken in July. Additionally, all but one individual of those constituting the 20 per cent occurring as immature *Oswaldocruzia* in the period August to September were actually collected in

early August. These were found in one salamander, and this constituted the heaviest infection for the period; crowding effects may have led to retardation of development of the worms.

If it is true that parasites are reacquired each spring—we assume that no temperature factors or immune reactions are delaying development of the worms, and no unusually long external ovic or free-living phase is a necessary part of their life-history—then the host-parasite data can be used as a basis for hypothesizing about the winter life of the salamander. During "surface" life the incidence of parasitism is high (90 per cent and 83 per cent: see Table 2), indicating that salamanders are readily invaded in times of activity. Salamanders examined in September were all parasitized and probably carried nematodes with them into their winter retreats. This part of their habitat should thus be contaminated with infective stages of both parasites. Yet the salamanders seem to become re-infected when the period of summer activity starts (note the high incidence of immature parasites in salamanders taken in July); therefore, the salamanders lose their worms in winter. This suggests that during their subterranean life salamanders are inactive, and avoid ingestion of infective stages of the parasites. A fairly complete hibernation such as we suppose they undergo has been reported by Szymanski (1914) for *Salamandra* on the basis of kymographic records of movement.

Characteristics of Breeding

Sex-ratio

Tables 3 and 4 show the distribution of sexes for two subsections of our sample. The ratio of males to females in the total sample was nearly 1:1. There were differences in ratios between the three general localities: the two northerly sites had fewer females than males, when compared with the Cloudcroft samples. This is true for the samples of adults, but not for the juveniles, where [Pg 581] in each instance the females predominated. We cannot absolutely explain these differences in ratios. Possibly the data on adults reflect different patterns of activity among the sexes so that adult females are simply not present in numbers where we looked for them. They could be located underground, in connection with "incubating" duties; if this is true it would account for the fact that so few egg-clusters have been found in logs.

TABLE 3.—SEX RATIOS IN ANEIDES HARDII, TOTAL SAMPLE

LOCALITY	Number of males	Number of females	Ratio of males to females
Capitan Mountains	35	31	100:87

Sierra Blanca	28	21	100:75
Sacramentos, 1958	23	20	100:121
Sacramentos, '56-'57	34	43	100:126
All	120	123	1:1

TABLE 4.—SEX RATIOS IN ANEIDES HARDII, ADULTS

LOCALITY	Number of males	Number of females	Ratio of males to females
Capitan Mountains	35	19	100:54
Sierra Blanca	22	7	100:32
Sacramentos, 1958	15	14	100:93
Sacramentos, '56-'57	22	16	100:73

[Pg 582]

Age-ratio

The data in Table 5 show adult salamanders to outnumber young at each collecting locality. This is probably not an accurate reflection of actual age composition in this species. Yet, we obtained the same general result in all three years of the study. We assume, therefore, that young were located where we could not catch many of them; probably they were underground. Sites of hatching and of the activities of early life would thus occur where we think the bulk of eggs are laid.

TABLE 5.—AGE RATIOS, ADULTS-JUVENILES

LOCALITY	Number of adults	Number of juveniles	Ratio of adults to juveniles
Capitan Mountains	57	15	100:26
Sierra Blanca	30	22	100:73

Sacramentos, 1958	42	30	100:71
Sacramentos, '56-'57	46	35	100:76
All	175	102	100:58

For purposes of this study we had only to age the individuals into adult and subadult classes. The criterion for adult status was breeding capability. A five-millimeter testis was the smallest size found in individuals that probably bred, and all of these were 40 mm. or more in snout-vent length. We arbitrarily considered individuals smaller than 40 mm. to be subadult. This probably does injustice to reality (females were treated the same way), but it should be noted that any error introduced in this way was almost certain to have increased the number of "subadults" in the samples. Thus, the hypothesis above based on age-ratios is not automatically invalid because of improper aging.

Timing of the breeding season

The time in which egg-clusters are deposited is a good rough index to events in the breeding cycle. We found four egg-clusters, one on July 14, 1957, and three on July 27, 1957; the only other eggs taken to date were found in late August (Lowe, 1950:94). Thus, courtship could occur in June, oviposition in July and August, and hatching from August to September. Actually, it is likely that the season is more restricted in time for any one year. Lowe's find was made in a year in which the summer rains were late, beginning in late July (Stebbins, 1951:137), whereas ours were made in a year having abundant and relatively early rainfall, beginning in late June. Microclimatic humidity is of extreme importance to both the salamanders and their food.

We suppose a great deal of breeding activity takes place underground; the chronology of events in such sites may bear no close relationship to those occurring at the surface, yet it is likely that a close parallel would be found. Breeding activities are ordinarily associated in time with greatest food abundance.[Pg 583]

Clutch-size

By clutch-size we refer to the number of eggs in laid clusters. We collected clutches of six, four, four and one; adding one more of three (Lowe, *op. cit.*) gives an average of 3.6 eggs per cluster; the average is 4.2 eggs if our clutch of one is discarded on the grounds it was incomplete.

For comparison we have listed (Table 6) clutch-sizes for some other plethodontids. It should be noted that these numbers refer only to eggs deposited in clusters, and not to large ovarian eggs. Thus, *Aneides hardii* has the lowest range in clutch-size of any North American plethodontid on record. It has been noted in other species that low

clutch-size is correlated with low productivity, slow population turnover, and long average life-expectancy (Lack, 1954:103-105; Pitelka and Johnston, MS). If this is the case with this salamander, several other features in its environment and habits would tend to reinforce such population structure: the animals are exceedingly well-concealed (they were first described only 17 years ago [Taylor, 1941]), apparently have few natural enemies (one garter snake [*Thamnophis*] was collected within the habitat of the salamander in three years), apparently have few and benign parasites, and abundant and readily available food.

TABLE 6.—RANGES AND MEAN VALUES OF CLUTCH-SIZES IN SALAMANDERS OF THE NORTH AMERICAN PLETHODONTIDAE^[1]

	Range	Mean
<i>Desmognathus</i> spp. ^[2]	11-40	20
<i>Leurognathus marmorata</i>	28	
<i>Plethodon cinereus</i>	3-13	9
<i>Plethodon</i> spp.	8-18	13
<i>Ensatina eschscholtzii</i>	12-14	13
<i>Hemidactylium scutatum</i>	30	
<i>Batrachoseps</i> spp.	7-74	
<i>Aneides hardii</i> ^[3]	1-6	3.6
<i>Aneides</i> spp.	7-19	13
<i>Stereochilus marginatus</i>		57
<i>Pseudotriton ruber</i>	72	
<i>Manculus quadridigitatus</i>	3-48	

[1]From Bishop (1947) and Stebbins (1951).

[2]Clusters of one and two occasionally found in *D. ochrophaeus*.

[3]This study, and from Lowe (1950).[Pg 584]

Eggs and "incubation"

Our information concerning eggs essentially duplicates that already reported (see Stebbins, 1951). All egg clusters that we found were in small chambers within decomposing fir logs. In each instance the eggs were suspended from the roofs of the chambers. The clutch of six eggs was a compact mass, and the individual suspensory cables of the eggs were intertwined and fused with one another. The clutches of four eggs, although they too were compact clusters, had each suspensory pedicel distinct from the others. The surface of the eggs was lightly moist, but did not glisten with water, and each egg was completely free of the others. The outer coat of jelly of the fresh eggs measured about 6.4 by 5.7 mm. as they hung suspended; sizes were uniform and no egg was notably smaller or larger than the others.

We attempted to keep eggs artificially, but mold destroyed them after 12 days. We had difficulty keeping them wet without inundating them, for the climate at Las Cruces, New Mexico, where we kept the eggs, is exceedingly dry in summer. Until death, embryos were active and responsive to disturbances around them. This was at a time when the limb buds could not be detected and when the external gills were evident only under close scrutiny.

Two times we found adult female salamanders in the chambers with the egg clusters. The other two egg clutches seemingly had no attendant adult, but our method of going through a log was such that we could easily have alarmed any attendant animal well before we found the eggs, allowing time for the adult to move away from the eggs. We presume that incubation, so-called, in *A. hardii* is similar to that found in other plethodontids (see, for example, Gordon, 1952:683). Our findings on the conditions of the stomachs of these attendant adults have been outlined above ("Food and Foraging"). Our limited data suggest that only females are found in chambers with eggs.

Summary

The montane relict plethodontid *Aneides hardii* was studied in the field and laboratory in 1956-1958. Food items detected in a small sample of stomachs are listed tabularly. Two roundworms were found to parasitize the guts of the salamanders; the parasitism looks to be benign. Subterranean winter inactivity is thought to be an integral part of the salamanders' lives, and is suggested in part [Pg 585] by the life cycles of the worms. Summer activity appears to occur at the ground surface in logs and talus, and underground; the latter site is suggested by certain ratios obtained in the samples, showing adults to outnumber young and males to outnumber females. The season for egg deposition seems to be in July and August. Clutch-size is lower than for any other plethodontid on record. "Incubation" of eggs apparently parallels that characteristic of other plethodontids.

Literature Cited

BISHOP, S. C.

1947. Handbook of salamanders. Ithaca, Comstock. xiv + 555 pp.

GORDON, R. E.

1952. A contribution to the life history and ecology of the plethodontid salamander *Aneides aeneus* (Cope and Packard). Amer. Midl. Nat., 47:666-701.

LACK, D.

1954. The natural regulation of animal numbers. Oxford, Clarendon, viii + 343 pp.

LOWE, C. H., JR.

1950. The systematic status of the salamander *Plethodon hardii*, with a discussion of biogeographic problems in *Aneides*. Copeia, 1950(2):92-99.

STEBBINS, R. C.

1951. Amphibians of western North America. Berkeley, Univ. Calif, xviii + 539 pp.

SZYMANSKI, J. S.

1914. Eine Methode zur Untersuchung der Ruhe- und Aktivitätsperioden bei Tieren. Arch. ges. Physiol., 158:343-385.

TAYLOR, E. H.

1941. A new plethodont salamander from New Mexico. Proc. Biol. Soc. Wash., 54:77-79.

Transmitted May 11, 1959.

27-9040

Transcriber's Notes:

Changed "vestigial" to "vestigial" on page 578: vestigial-winged flies.

Changed "inmature" to "immature" in Table 2: nematodes that were immature.

Changed "auomatically" to "automatically" on page 582: not auomatically invalid.

Changed "Syzmanski" to "Szymanski" in Literature Cited on page 585.

*** END OF THE PROJECT GUTENBERG EBOOK NATURAL HISTORY OF THE SALAMANDER, ANEIDES
HARDII ***

Updated editions will replace the previous one—the old editions will be renamed.

Creating the works from print editions not protected by U.S. copyright law means that no one owns a United States copyright in these works, so the Foundation (and you!) can copy and distribute it in the United States without permission and without paying copyright royalties. Special rules, set forth in the General Terms of Use part of this license, apply to copying and distributing Project Gutenberg™ electronic works to protect the PROJECT GUTENBERG™ concept and trademark. Project Gutenberg is a registered trademark, and may not be used if you charge for an eBook, except by following the terms of the trademark license, including paying royalties for use of the Project Gutenberg trademark. If you do not charge anything for copies of this eBook, complying with the trademark license is very easy. You may use this eBook for nearly any purpose such as creation of derivative works, reports, performances and research. Project Gutenberg eBooks may be modified and printed and given away—you may do practically ANYTHING in the United States with eBooks not protected by U.S. copyright law. Redistribution is subject to the trademark license, especially commercial redistribution.

START: FULL LICENSE

THE FULL PROJECT GUTENBERG LICENSE

PLEASE READ THIS BEFORE YOU DISTRIBUTE OR USE THIS WORK

To protect the Project Gutenberg™ mission of promoting the free distribution of electronic works, by using or distributing this work (or any other work associated in any way with the phrase “Project Gutenberg”), you agree to comply with all the terms of the Full Project Gutenberg™ License available with this file or online at www.gutenberg.org/license.

Section 1. General Terms of Use and Redistributing Project Gutenberg™ electronic works

1.A. By reading or using any part of this Project Gutenberg™ electronic work, you indicate that you have read, understand, agree to and accept all the terms of this license and intellectual property (trademark/copyright) agreement. If you do not agree to abide by all the terms of this agreement, you must cease using and return or destroy all copies of Project Gutenberg™ electronic works in your possession. If you paid a fee for obtaining a copy of or access to a Project Gutenberg™ electronic work and you do not agree to be bound by the terms of this agreement, you may obtain a refund from the person or entity to whom you paid the fee as set forth in paragraph 1.E.8.

1.B. “Project Gutenberg” is a registered trademark. It may only be used on or associated in any way with an electronic work by people who agree to be bound by the terms of this agreement. There are a few things that you can do with most Project Gutenberg™ electronic works even without complying with the full terms of this agreement. See paragraph 1.C below. There are a lot of things you can do with Project

Gutenberg™ electronic works if you follow the terms of this agreement and help preserve free future access to Project Gutenberg™ electronic works. See paragraph 1.E below.

1.C. The Project Gutenberg Literary Archive Foundation (“the Foundation” or PGLAF), owns a compilation copyright in the collection of Project Gutenberg™ electronic works. Nearly all the individual works in the collection are in the public domain in the United States. If an individual work is unprotected by copyright law in the United States and you are located in the United States, we do not claim a right to prevent you from copying, distributing, performing, displaying or creating derivative works based on the work as long as all references to Project Gutenberg are removed. Of course, we hope that you will support the Project Gutenberg™ mission of promoting free access to electronic works by freely sharing Project Gutenberg™ works in compliance with the terms of this agreement for keeping the Project Gutenberg™ name associated with the work. You can easily comply with the terms of this agreement by keeping this work in the same format with its attached full Project Gutenberg™ License when you share it without charge with others.

1.D. The copyright laws of the place where you are located also govern what you can do with this work. Copyright laws in most countries are in a constant state of change. If you are outside the United States, check the laws of your country in addition to the terms of this agreement before downloading, copying, displaying, performing, distributing or creating derivative works based on this work or any other Project Gutenberg™ work. The Foundation makes no representations concerning the copyright status of any work in any country other than the United States.

1.E. Unless you have removed all references to Project Gutenberg:

1.E.1. The following sentence, with active links to, or other immediate access to, the full Project Gutenberg™ License must appear prominently whenever any copy of a Project Gutenberg™ work (any work on which the phrase “Project Gutenberg” appears, or with which the phrase “Project Gutenberg” is associated) is accessed, displayed, performed, viewed, copied or distributed:

This eBook is for the use of anyone anywhere in the United States and most other parts of the world at no cost and with almost no restrictions whatsoever. You may copy it, give it away or re-use it under the terms of the Project Gutenberg License included with this eBook or online at www.gutenberg.org. If you are not located in the United States, you will have to check the laws of the country where you are located before using this eBook.

1.E.2. If an individual Project Gutenberg™ electronic work is derived from texts not protected by U.S. copyright law (does not contain a notice indicating that it is posted with permission of the copyright holder), the work can be copied and distributed to anyone in the United States without paying any fees or charges. If you are redistributing or providing access to a work with the phrase “Project Gutenberg” associated with or appearing on the work, you must comply either with the requirements of paragraphs 1.E.1 through 1.E.7 or obtain permission for the use of the work and the Project Gutenberg™ trademark as set forth in paragraphs 1.E.8 or 1.E.9.

1.E.3. If an individual Project Gutenberg™ electronic work is posted with the permission of the copyright holder, your use and distribution must comply with both paragraphs 1.E.1 through 1.E.7 and any additional terms imposed by the copyright holder. Additional terms will be linked to the Project

Gutenberg™ License for all works posted with the permission of the copyright holder found at the beginning of this work.

1.E.4. Do not unlink or detach or remove the full Project Gutenberg™ License terms from this work, or any files containing a part of this work or any other work associated with Project Gutenberg™.

1.E.5. Do not copy, display, perform, distribute or redistribute this electronic work, or any part of this electronic work, without prominently displaying the sentence set forth in paragraph 1.E.1 with active links or immediate access to the full terms of the Project Gutenberg™ License.

1.E.6. You may convert to and distribute this work in any binary, compressed, marked up, nonproprietary or proprietary form, including any word processing or hypertext form. However, if you provide access to or distribute copies of a Project Gutenberg™ work in a format other than “Plain Vanilla ASCII” or other format used in the official version posted on the official Project Gutenberg™ website (www.gutenberg.org), you must, at no additional cost, fee or expense to the user, provide a copy, a means of exporting a copy, or a means of obtaining a copy upon request, of the work in its original “Plain Vanilla ASCII” or other form. Any alternate format must include the full Project Gutenberg™ License as specified in paragraph 1.E.1.

1.E.7. Do not charge a fee for access to, viewing, displaying, performing, copying or distributing any Project Gutenberg™ works unless you comply with paragraph 1.E.8 or 1.E.9.

1.E.8. You may charge a reasonable fee for copies of or providing access to or distributing Project Gutenberg™ electronic works provided that:

- • You pay a royalty fee of 20% of the gross profits you derive from the use of Project Gutenberg™ works calculated using the method you already use to calculate your applicable taxes. The fee is owed to the owner of the Project Gutenberg™ trademark, but he has agreed to donate royalties under this paragraph to the Project Gutenberg Literary Archive Foundation. Royalty payments must be paid within 60 days following each date on which you prepare (or are legally required to prepare) your periodic tax returns. Royalty payments should be clearly marked as such and sent to the Project Gutenberg Literary Archive Foundation at the address specified in Section 4, “Information about donations to the Project Gutenberg Literary Archive Foundation.”
- • You provide a full refund of any money paid by a user who notifies you in writing (or by e-mail) within 30 days of receipt that s/he does not agree to the terms of the full Project Gutenberg™ License. You must require such a user to return or destroy all copies of the works possessed in a physical medium and discontinue all use of and all access to other copies of Project Gutenberg™ works.
- • You provide, in accordance with paragraph 1.F.3, a full refund of any money paid for a work or a replacement copy, if a defect in the electronic work is discovered and reported to you within 90 days of receipt of the work.
- • You comply with all other terms of this agreement for free distribution of Project Gutenberg™ works.

1.E.9. If you wish to charge a fee or distribute a Project Gutenberg™ electronic work or group of works on different terms than are set forth in this agreement, you must obtain permission in writing from the

Project Gutenberg Literary Archive Foundation, the manager of the Project Gutenberg™ trademark. Contact the Foundation as set forth in Section 3 below.

1.F.

1.F.1. Project Gutenberg volunteers and employees expend considerable effort to identify, do copyright research on, transcribe and proofread works not protected by U.S. copyright law in creating the Project Gutenberg™ collection. Despite these efforts, Project Gutenberg™ electronic works, and the medium on which they may be stored, may contain “Defects,” such as, but not limited to, incomplete, inaccurate or corrupt data, transcription errors, a copyright or other intellectual property infringement, a defective or damaged disk or other medium, a computer virus, or computer codes that damage or cannot be read by your equipment.

1.F.2. LIMITED WARRANTY, DISCLAIMER OF DAMAGES - Except for the “Right of Replacement or Refund” described in paragraph 1.F.3, the Project Gutenberg Literary Archive Foundation, the owner of the Project Gutenberg™ trademark, and any other party distributing a Project Gutenberg™ electronic work under this agreement, disclaim all liability to you for damages, costs and expenses, including legal fees. YOU AGREE THAT YOU HAVE NO REMEDIES FOR NEGLIGENCE, STRICT LIABILITY, BREACH OF WARRANTY OR BREACH OF CONTRACT EXCEPT THOSE PROVIDED IN PARAGRAPH 1.F.3. YOU AGREE THAT THE FOUNDATION, THE TRADEMARK OWNER, AND ANY DISTRIBUTOR UNDER THIS AGREEMENT WILL NOT BE LIABLE TO YOU FOR ACTUAL, DIRECT, INDIRECT, CONSEQUENTIAL, PUNITIVE OR INCIDENTAL DAMAGES EVEN IF YOU GIVE NOTICE OF THE POSSIBILITY OF SUCH DAMAGE.

1.F.3. LIMITED RIGHT OF REPLACEMENT OR REFUND - If you discover a defect in this electronic work within 90 days of receiving it, you can receive a refund of the money (if any) you paid for it by sending a written explanation to the person you received the work from. If you received the work on a physical medium, you must return the medium with your written explanation. The person or entity that provided you with the defective work may elect to provide a replacement copy in lieu of a refund. If you received the work electronically, the person or entity providing it to you may choose to give you a second opportunity to receive the work electronically in lieu of a refund. If the second copy is also defective, you may demand a refund in writing without further opportunities to fix the problem.

1.F.4. Except for the limited right of replacement or refund set forth in paragraph 1.F.3, this work is provided to you ‘AS-IS’, WITH NO OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PURPOSE.

1.F.5. Some states do not allow disclaimers of certain implied warranties or the exclusion or limitation of certain types of damages. If any disclaimer or limitation set forth in this agreement violates the law of the state applicable to this agreement, the agreement shall be interpreted to make the maximum disclaimer or limitation permitted by the applicable state law. The invalidity or unenforceability of any provision of this agreement shall not void the remaining provisions.

1.F.6. INDEMNITY - You agree to indemnify and hold the Foundation, the trademark owner, any agent or employee of the Foundation, anyone providing copies of Project Gutenberg™ electronic works in accordance with this agreement, and any volunteers associated with the production, promotion and distribution of Project Gutenberg™ electronic works, harmless from all liability, costs and expenses, including legal fees, that arise directly or indirectly from any of the following which you do or cause to

occur: (a) distribution of this or any Project Gutenberg™ work, (b) alteration, modification, or additions or deletions to any Project Gutenberg™ work, and (c) any Defect you cause.

Section 2. Information about the Mission of Project Gutenberg™

Project Gutenberg™ is synonymous with the free distribution of electronic works in formats readable by the widest variety of computers including obsolete, old, middle-aged and new computers. It exists because of the efforts of hundreds of volunteers and donations from people in all walks of life.

Volunteers and financial support to provide volunteers with the assistance they need are critical to reaching Project Gutenberg™'s goals and ensuring that the Project Gutenberg™ collection will remain freely available for generations to come. In 2001, the Project Gutenberg Literary Archive Foundation was created to provide a secure and permanent future for Project Gutenberg™ and future generations. To learn more about the Project Gutenberg Literary Archive Foundation and how your efforts and donations can help, see Sections 3 and 4 and the Foundation information page at www.gutenberg.org.

Section 3. Information about the Project Gutenberg Literary Archive Foundation

The Project Gutenberg Literary Archive Foundation is a non-profit 501(c)(3) educational corporation organized under the laws of the state of Mississippi and granted tax exempt status by the Internal Revenue Service. The Foundation's EIN or federal tax identification number is 64-6221541. Contributions to the Project Gutenberg Literary Archive Foundation are tax deductible to the full extent permitted by U.S. federal laws and your state's laws.

The Foundation's business office is located at 809 North 1500 West, Salt Lake City, UT 84116, (801) 596-1887. Email contact links and up to date contact information can be found at the Foundation's website and official page at www.gutenberg.org/contact

Section 4. Information about Donations to the Project Gutenberg Literary Archive Foundation

Project Gutenberg™ depends upon and cannot survive without widespread public support and donations to carry out its mission of increasing the number of public domain and licensed works that can be freely distributed in machine-readable form accessible by the widest array of equipment including outdated equipment. Many small donations (\$1 to \$5,000) are particularly important to maintaining tax exempt status with the IRS.

The Foundation is committed to complying with the laws regulating charities and charitable donations in all 50 states of the United States. Compliance requirements are not uniform and it takes a considerable effort, much paperwork and many fees to meet and keep up with these requirements. We do not solicit donations in locations where we have not received written confirmation of compliance. To SEND DONATIONS or determine the status of compliance for any particular state visit www.gutenberg.org/donate.

While we cannot and do not solicit contributions from states where we have not met the solicitation requirements, we know of no prohibition against accepting unsolicited donations from donors in such states who approach us with offers to donate.

International donations are gratefully accepted, but we cannot make any statements concerning tax treatment of donations received from outside the United States. U.S. laws alone swamp our small staff.

Please check the Project Gutenberg web pages for current donation methods and addresses. Donations are accepted in a number of other ways including checks, online payments and credit card donations. To donate, please visit: www.gutenberg.org/donate

Section 5. General Information About Project Gutenberg™ electronic works

Professor Michael S. Hart was the originator of the Project Gutenberg™ concept of a library of electronic works that could be freely shared with anyone. For forty years, he produced and distributed Project Gutenberg™ eBooks with only a loose network of volunteer support.

Project Gutenberg™ eBooks are often created from several printed editions, all of which are confirmed as not protected by copyright in the U.S. unless a copyright notice is included. Thus, we do not necessarily keep eBooks in compliance with any particular paper edition.

Most people start at our website which has the main PG search facility: www.gutenberg.org.

This website includes information about Project Gutenberg™, including how to make donations to the Project Gutenberg Literary Archive Foundation, how to help produce our new eBooks, and how to subscribe to our email newsletter to hear about new eBooks.