



THREE

**Introductory
Lessons
Salmon**

Man: A Course of Study

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INTRODUCTORY LESSONS / SALMON

INTRODUCTORY LESSONS

3

SALMON

27

INTRODUCTORY LESSONS: WHAT'S IN A LIFETIME?

INTRODUCTION

The first several days of Man: A Course of Study bring the child into the course by making him, his friends, the human species, the subject of the lessons. Many of the questions raised are segments of the questions upon which the entire course is based: Who am I? What makes me human? What makes man human? Some of the questions concern learning: What do human beings learn during their lifetimes? From whom do they learn? Do all people learn the same things? Learning and how it affects our behavior are primary foci of the course.

Another emphasis is upon the life cycle: What things happen during one person's lifetime that happen to all people, to all living things? How does life go on even though individuals die? Some questions have no final answers; yet they may lead to a greater understanding of one's own past and place in the world today.

Other questions raised here concern emotions--love, anger, joy, sorrow--and the part they play in a human lifetime. Later in the course, ties of affection and control of aggression will be discussed.

As the children begin to consider what distinguishes human beings from other animals, questions are raised about language, tool use, and families, all of which are part of the larger questions that are essential to the course.

There is no need for final answers at this point or, perhaps, at any time. Most important, throughout the course, questions should be raised which cause the child to reflect upon his own existence, and see himself and everything around him in a new way.

Bibliography

See the bibliography in A Guide to the Course for publication information about these books and for additional titles.

* Cohen, Robert, and Ken Heyman, The Color of Man

* Steichen, E., The Family of Man

Lorenz, Konrad Z., King Solomon's Ring

Muessig, Raymond H., Discussion Pictures for Beginning Social Studies

* Books essential for classroom library.

INTRODUCTORY LESSONS: WHAT'S IN A LIFETIME?

A. MAN, ALL MEN (2 days) 8

This lesson emphasizes the similar needs, thoughts and feelings of all men.

B. LIFETIMES AND LIFE CYCLES (2 days) 13

Individual lifetimes end, but life goes on. Characteristics and traditions are passed down from generation to generation.

C. LOOKING AT MAN AND OTHER ANIMALS (1 day) 18

Whatever differences exist among individuals and cultures, all men belong to the same species. In order to understand better the uniqueness of that species, the children will study other animals as they study themselves.

Before teaching these lessons, it is helpful to read all of the Introductory Lessons (through page 25 of this manual).

A. Man, All Men

2 DAYS

The purpose of the first few days is to provide experiences for children that allow them to consider the common feelings and needs of all mankind. Suggested here are activities using pictures, poems and boxes that give each child an opportunity to express his thoughts.

There are several ways that the poems and pictures can be used. We suggest that each child choose a theme (such as birth, death, loving, playing), find a poem and pictures to accompany that theme, then paste the poem and pictures on the outside of a box. (We suggest a box because it is an interesting and unusual medium for children. Flat cardboard can be used if boxes are not available.) Perhaps some children would prefer to look through the poems or pictures before choosing their themes.

The second part of this lesson is based upon photographs of themselves that the children bring in. This should help them see that the course is about them, and that they, as members of the human species, share the thoughts and feelings and needs of others.

With these ideas in mind, the following two-day sequence is suggested.

DAY 1

Picture magazines such as Life, Ebony or Look, or paperback copies of Family of Man that can be cut up
Poems--dittoed from poetry books, (see pp. 24-25)
Enough boxes for each child in your class (shoe boxes, cereal boxes; any medium-sized box)
Glue
(Special picture sets can be ordered. See Raymond H. Muessig, Discussion Pictures for Beginning Social Studies, listed in bibliography.)

1. DISCUSSING LIFETIME OCCURRENCES

Discuss with your students: What do people do during their lifetimes? What are some of the ways they feel? What do they think about? What makes a human being human? What makes you human? To start discussion, you might read a poem such as the following from Ecclesiastes.

To every thing there is a season, and a time to every purpose under the heaven:

A time to be born, and a time to die;
a time to plant, and a time to pluck up that which is planted;

A time to kill, and a time to heal;
a time to break down, and a time to build up;

A time to weep, and a time to laugh;
a time to mourn, and a time to dance;

A time to cast away stones, and a time to gather stones together;
a time to embrace, and a time to refrain from embracing;

A time to get, and a time to lose;
a time to keep, and a time to cast away;

A time to rend, and a time to sew;
a time to keep silence, and a time to speak;

A time to love, and a time to hate;
a time of war, and a time of peace.

Ecclesiastes 3:1-8

As the children mention their ideas, ask which of the activities, thoughts or feelings they are describing are shared by all men, and which ones are not.

2. CHOOSING THEMES AND PICTURES

Each child may choose a theme such as birth, death, growing, living, loving, fighting, working, playing--something that occurs during their own lifetimes and during the lives of all men. Some children might want to choose a series of events, such as those that might occur in a typical day of a ten-year-old child. Explain that they are to find pictures and perhaps poems about the theme they choose, and arrange and paste them on the outside of a box. See pages 24-25 of this manual for suggestions about poems.

INTRODUCTORY LESSONS

10

Since the subject of the lesson is all mankind, it is important that the pictures from which the children choose include people of all ages, races and economic conditions. During this activity, some children may wish to work with another child; others may prefer to work alone.

As they finish their montages, ask the children to look at the boxes of other children and consider how the themes on the boxes are similar and different.

3. HOMEWORK ASSIGNMENT

Ask each child to bring in a photograph of himself. The photograph should show the child doing something. Children who cannot get photographs could draw pictures of themselves. Ask each child to write a short paragraph about what he is doing or feeling or thinking in his photograph or drawing.

DAY 2

Photographs or pictures of children
Dittoed sheets with questions (to be prepared before class)
Montage boxes from previous day

1. DISPLAYING PHOTOGRAPHS

Photographs that should not be destroyed might be displayed on a bulletin board. Others might be added to the montages, or some children might like to make other montages based upon the subject of their photographs or drawings.

2. PREPARED QUESTION SHEETS

Distribute prepared dittoed sheets with instructions and questions like the following, leaving room for the children to respond:

Find pictures on classmates' boxes of people doing the same kind of thing that you are doing in your photograph or picture.

Is it something that people all over the world would do?

Are you doing something people of different ages would do?

How did you learn to do it?

How were you feeling as you did it? Would other people be likely to be feeling the same thing?

3. OBSERVING THE PHOTOGRAPHS

Each child, given one or more of the dittoed sheets, could observe the photographs around the room, answering the questions on the sheet. After a while, the class can be brought back together to discuss some of the photographs. Or small groups of children can look at the photographs and answer the questions together.

4. DISCUSS AS A CLASS SOME OF THE FOLLOWING QUESTIONS

Is there anything you like to do that the person sitting next to you doesn't like to do?

How did you learn to feel the way you do about it?

How did your classmate learn to feel the way he feels?

What are some of the important things that you think are true for all people, all over the world?

These questions should raise the idea that there are always differences between people: differences in what they choose to do and how they feel about what they do. But underlying these differences are many similarities: all people feel certain emotions, all people learn, all people can feel different ways about the same thing, all people make choices. And all people share the life cycle events of birth, growth, reproduction and death.

5. WHAT MAKES MAN HUMAN?

A final discussion should center around this question. As the children discuss it, you could have them write their answers on small cards and

INTRODUCTORY LESSONS

12

choose some of their photographs or pictures to put on a bulletin board. The title of the board should be: What Makes Man Human? You might want to keep the board for the first half of the year, and every once in a while ask the children to add new thoughts that they have.

B. Lifetimes and Life Cycles

2 DAYS

In the previous lesson, the children saw themselves as members of the human species. In this lesson, they consider what happens during a human lifetime, and then are asked to think about how much of what they expect to happen to them as adults is influenced by what they see and are taught as children. What about children in other parts of the world? In what important ways are their lifetimes similar to or different from ours? Finally, the children are introduced to the idea of the cycle of life. All living things are born, reproduce and die. Although individual lives come to an end, life continues, and characteristics and traditions are passed on from generation to generation.

Booklet, Life Cycle

Heavy string cut into 3- or 4-foot pieces, one for each child
Enough 3 x 5 cards for each child to have as many as he wants
Tape, wire, or something to attach cards to string
Crayons

1. REVIEWING LIFETIME EVENTS

Discuss with the class: What are some of the things that happen during a human lifetime? (The photographs from the previous lesson may suggest some of the events.)

2. INTRODUCING LIFE ROPES

Take one of the strings and either tape it to the board or have two children hold it. Explain that it represents a human lifetime with a beginning and an end. About how long a time does this rope represent if it is an

average human lifetime? (An average American lifetime is about 70 years.) What would one end represent? The other? Have a child write "birth" on one card and "death" on another, and attach the cards to the line. Explain that between birth and death many things happen. The children should put cards representing some of these things on the line.

3. DISTRIBUTING MATERIALS

When the children understand the task, distribute rope and cards and ask each child or small groups of children to construct human lifetimes. They may use either drawings or words to represent the events. Some things, such as learning to talk, happen over a period of time, not all at once. You might suggest that the children draw an arrow on cards to indicate a process in time.

Some teachers have found it best to limit the number of cards each child receives to eight or ten, so that no child becomes frightened by the size of the task. We suggest, however, that you let the children use as many cards as they wish; when they are finished, ask them to mark the most important ones.

(To display the pieces, some teachers have mounted them on stiff paper before attaching them to the walls.)

4. QUESTIONS TO DISCUSS

As the children are finishing their ropes, discuss some of the following questions:

Which of the events you have listed seem to you to be the most important? Why?

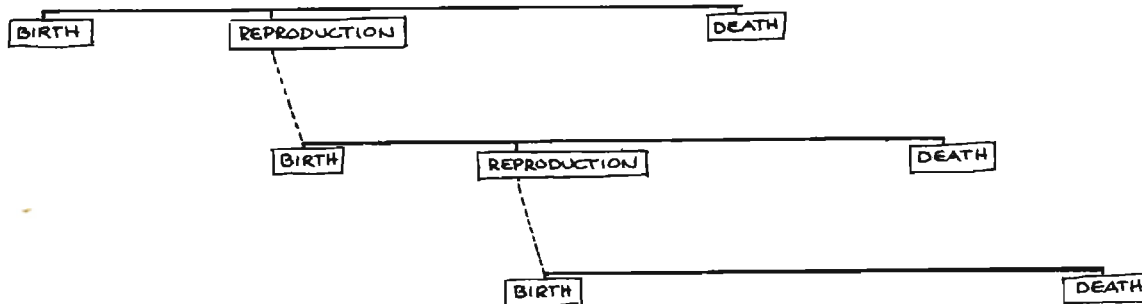
Are there differences between what you think is important and what some of your classmates think is important?

Would people in all parts of this country think the same things were important? What things do you imagine people everywhere would think were important?

How do you explain the differences between what you think is important and what people in other parts of the country or world think is important?

5. INTRODUCING THE LIFE CYCLE BOOKLET

Take one of the life ropes and hold beneath it another rope, explaining that the second "lifetime" represents a child of the first. What would we call the first "lifetime"? What happens during the time represented by the overlap of the two lines? Add another rope. How are the three lifetimes related? What would the people call each other?



About how long is the period of overlap? What would it be like if there were no overlap at all? During the part of the overlap period when you are a child, what goes on? How does your childhood affect what you become as an adult? What do people in other parts of the country or world learn that is different from what you learn during this period?

6. READING THE BOOKLET

As you read the booklet with the children, be sure to discuss the drawings of the life cycle, pointing out that it takes two animals to reproduce. If questions about reproduction are raised, see page 49 in this teacher's guide. You could most simply answer that the male animal supplies a tiny cell, the sperm. The female animal supplies a tiny cell called the egg. When the two come together, a new life is formed.

7. HOMEWORK ASSIGNMENT

The last part of the life cycle booklet discusses the passing down of characteristics. For a homework assignment, ask the children to look for baby or childhood pictures of their parents. Do you look anything like your parents when they were your age? What were your parents doing then? Did they do things similar to or different from what you are doing?

What physical characteristics do you have that are similar to characteristics of one of your parents or grandparents (hair color, eye color, shape of nose, and so forth)?

Does your family have any traditions that are passed down from one generation to another (such as special customs at holidays or birthdays)?

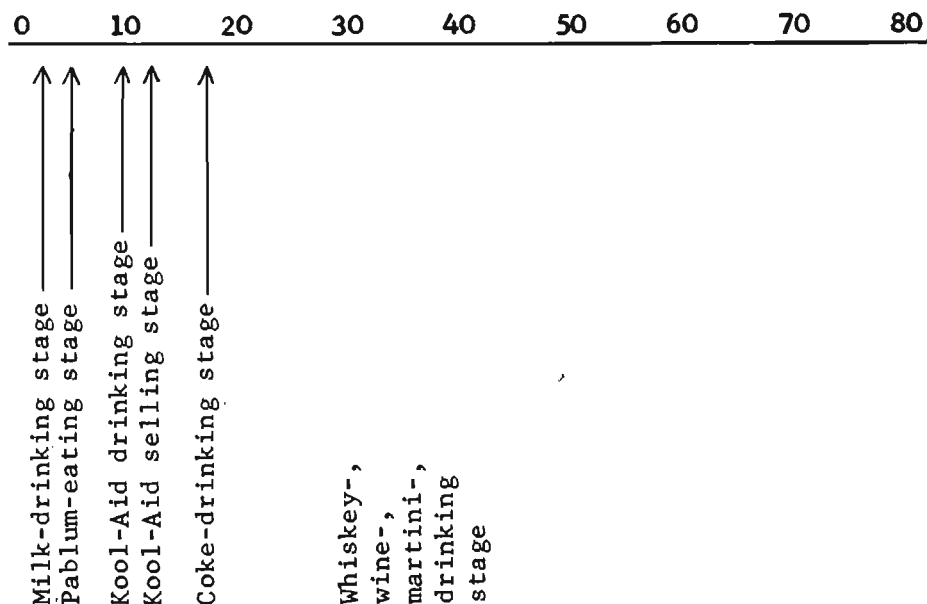
How do you learn what you should do at these times?

8. EXAMINING MONTAGES

Look at the pictures in the montages. Children could work individually or in small groups describing physical characteristics as well as customs and traditions that they think the people in a given picture would pass down from generation to generation.

9. OPTIONAL ASSIGNMENTS FOR CLASSROOM OR HOME

- a. Construct a life line of greeting cards.
- b. Make a life line of periods during a lifetime instead of events. Such periods might be: infant, child, pre-teenage, teenage, young adult, adult. Or, an American lifetime as described by one young student:



- c. One class made a life line extending the length of the hallway in their school. They marked ages at regular intervals. Then the children walked from one end to the other, pretending they were the different ages as they walked along. At the beginning of life they crawled, and at the end they tottered on their canes.
 - d. Some students might like to act out ways of behaving at different times of life. For example, the ways people sit during different ages of their lives, or ways that people act toward other people during different times in their lives.
 - e. One class made a life line of Dr. Martin Luther King. They were surprised to find that, unlike the lines they made of their own lifetimes, they could find out many things about his adult life but not much about him as a child. Making a rope of Dr. King's life dramatized how much does go on during an adult life. Some children in your class might enjoy making a life rope of a famous person.
 - f. You might tell the children about the riddle of the Sphinx. The Sphinx is supposed to have asked the wandering Oedipus, "What walks on four legs, then two legs, then three legs?" The answer: Man, who crawls as a baby, walks erect as an adult, and leans on a cane in old age.
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C. Looking at Man and Other Animals

1 DAY

In the previous lessons, the children have looked at the similarities and differences among members of the human species. Though there is enormous variety within the species, all men are members of one species. Now the children are introduced to the idea of studying other animals to understand this human species better. In what ways is man similar to and different from other animal species?

Record, "In the Field"
Filmstrip, "Looking at Animals"

Phonograph
Filmstrip projector

1. FOCUSING ON MAN AS AN ANIMAL

Discuss with your students: We have spent several days looking at human beings; what are some of the things we have said all men have in common? Explain that all men are members of the same species, that is, the same animal group. What makes man different from all other animals? Explain that this is the question that is to be the focus of work for the next several months.

Ask the children either in small groups or as a class to make a chart indicating:

How man is similar to other animals	How man is different from other animals

A few of the questions that might come up are given below. They raise issues that will be discussed throughout the course. At this point, you should encourage the children to begin to think critically about some of the things they have been taking for granted.

Do all animals marry? What would you say is the difference between human marriage and the "marriage" of other animals? Do all animals talk? What do you mean by talk? What is the difference between a human talking and a parrot talking? (Interested children might like to read the chapter on animal language in King Solomon's Ring, by Konrad Z. Lorenz.) What do we mean when we say that only man uses tools? Chimps have been seen using blades of grass to get insects out of dirt mounds. Is this using a tool?

Statements like "Man is different from other animals because he goes to school" often cause difficulties because children may point out that animals sometimes wander around in school buildings, and so forth. It is wise to limit the discussion to events that would occur in animals' lives without the presence of humans, that is, in the animals' natural state.

2. INTRODUCING THE FILMSTRIP

Explain to the class that they are going to look for similarities and differences between man and other animals in pictures of animals, and that the class will study these animals as the unit proceeds.

NOTE: As you show the filmstrip, play the record, side 1, or read the transcript found at the end of this lesson. If you read the script, be sure to practice before using the filmstrip with the class.

3. FOLLOWING THE FILMSTRIP

These questions should be discussed:

What questions do you have about the similarities and differences between you and other animals?

What things do you want to learn about salmon, herring gulls, baboons, chimps, yourselves?

INTRODUCTORY LESSONS

20

, 4. RETURNING TO LIFE ROPES

Ask the children to look back at the life ropes they constructed. Have them mark the cards with an X if the activity described pertains only to humans, and a question mark if they aren't sure and think it might also happen during the lifetimes of other animals.

TRANSCRIPT OF NARRATION: LOOKING AT ANIMALS

Transcribed below is the narration for the filmstrip band 1 of the record "In the Field." (Teachers with DuKane automatic synchronous equipment should advance the film to the title side, "Looking at Animals," and start record.)

/1/ Did you ever really look at animals? What is it /2/ in us that makes us so interested in animals? What is it /3/ that makes us want to pet them, and /4/ often to keep them as pets? What is it that makes /5/ us feel sometimes so very close to animals, and at other times /6/ so far removed from them? When we think that all /7/ of us--men, other animals, and even plants--are working at the problem of getting along in this world, then we can see how much we have in common with all forms of life.

/8/ In fact, we sometimes feel so close to animals that we imagine that they do things in their world very much as we do in ours, /9/ that they think and feel as we do, and that they do the same things to survive that we do. Often in stories, these animals are very much like us. /10/ For example, the fox and the grapes. A fox looked and beheld /11/ the grapes that grew upon a huge vine, /12/ which grapes he much desired for to eat them. /13/ But when he saw that none he might get, he turned his sorrow /14/ into joy and said, "These grapes are sour. And if I had some, I would not eat them."

But what are animals really like? /15/ To find out, people go on expeditions to the country--to rivers /16/ to watch salmon, /17/ to the shore to look at herring gulls.

1. Boy with squirrel
2. Girl with canary
3. Cat
4. Girl with goldfish
5. Hamsters
6. Lizard
7. Caribou

8. Boy and dog

9. Peacocks

10. Fox walking

11. Fox watching

12. Fox climbing

13. Fox crying

14. Fox laughing

15. Children in field

16. Salmon

17. Herring gull

INTRODUCTORY LESSONS

22

18. Man looking at herring gulls /18/ Some scientists stand for hours studying their habits, and others /19/ go out into the African plains to watch baboons.
19. Man looking at baboons

20. Baby baboon
21. Mother baboon and baby
22. Baby baboon
- With some animals it may be hard to see similarities to humans. But with others, like the baboons, /20/ it's easy to see similarities. And if we listen to one of Irven DeVore's stories about baboons, we learn that they act a lot like us too. /21/ "As you know, baboon infants always want to stay with their mothers, and this caused a great deal of difficulty. /22/ We were traveling across Africa and in the evenings, when we could, we went to small hotels so that we could have a shower and a nice hot meal. Well the moment we had to leave the little baboon in the hotel room to go into the dining room, it would begin crying and screaming because now I was its mother, and it wanted to always be with me just as little baboons always do. Well we had very little choice. First we tried to stand around in the room, all of us who were traveling together, and make sounds that baboons make in the evening when they are going to sleep. This is a kind of mournful, cooing sound like...(SOUNDS)... and sometimes the little baboon would go to sleep when it heard what sounded like a baboon troop making the evening sounds. But usually this didn't work, and so in order to keep the hotel manager from throwing us all out I would go and get the little baboon and put it inside my shirt because of course they wouldn't let a baboon in the dining room if they knew about it. One evening we were sitting there, and I noticed that the people at the next table were looking at me in utter amazement, and as I looked down I noticed that a little brown arm had come out from inside my shirt and was taking peas and potatoes off my plate. And then the little brown arm would disappear back inside my shirt."

Of course /23/ when we look at some kinds of animals, what we think are similarities are not really similarities at all. When we see herring gull chicks in the nest and watch the parents give them food, it looks like the same thing that human parents do with their young. But when we study /24/ herring gulls, we find that adult birds have a red spot on their bills, and that the chicks are born with an urge to peck at it. /25/26/27/ When the chick pecks at the spot, the parents gives it food. /28/29/ But the parent /30/ wouldn't even feed the chick unless it pecked at the parent's spot.

So this /31/ relationship ... may look like this /32/ ... but it really isn't the same. We can learn about what /33/ we are by learning what we are not, and why we are not. And we can learn about man by learning something about animals. /34/ We can learn in what ways we are similar, and in what ways we are different. That's why we want to look at animals, to read about animals, and especially to think about animals. And at the same time, to think about ourselves. /35/

23. Herring gull and chicks

24. Herring gull

25. Chick and egg

26. Chick and mother

27. Chick pecking

28. Mother with mouth open

29. Mother regurgitating

30. Chick eating

31. Chick on mother's back

32. Eskimo mother and child

33. Boy reading book

34. Girl reading book

35. Final slide

Poems for Use in Introductory Lessons

During the opening lessons, it is suggested that you have poems available for the children to use as they prepare their montages. Some poems that you might use and the books in which they can be found are listed below. (See the bibliography in A Guide to the Course for publication information about these books.) "Thumbprint" and "Dreams" are examples of appropriate poems.

The Arrow Book of Poetry, selected by Anne McGovern

"The Dream Keeper," Langston Hughes

"Primer Lesson," Carl Sandburg

It Doesn't Always Have to Rhyme, by Eve Merriam

"Conversation with Myself"

"Metaphor"

"Thumbprint"

"Ululation"

The Moment of Wonder, edited by Richard Lewis

"Parting," Wang Wei

Untitled poem, Pai-Ta Shun

Reflections on a Gift of Watermelon Pickle, edited by Stephen Dunning, Edward Lueders and Hugh Smith

"Apartment House," Gerald Raftery

"Dreams," Langston Hughes

"For a Dead Kitten," Sara Henderson Hay

"Husbands and Wives," Miriam Hersenson

"War," Dan Roth

The following books of poems are also recommended:

Cavalcade of Poems, edited by George Bennett and Paul Molloy

The Golden Journey: Poems for Young Children, compiled by Louise Bogan and William Jay Smith

Golden Slippers: An Anthology of Negro Poetry, compiled by Arna Bontemps

Miracles: Poems by Children of the English-Speaking World, edited by Richard Lewis

Wind Song, by Carl Sandburg

THUMBPRINT

In the heel of my thumb
are whorls, whirls, wheels
in a unique design:
mine alone.
What a treasure to own!
My own flesh, my own feelings.
No other, however grand or base,
can ever contain the same.
My signature,
thumbing the pages of time.
My universe key,
my singularity.
Impress, implant,
I am myself,
of all my atom parts I am the sum.
And out of my blood and my brain
I make my own interior weather,
my own sun and rain.
Imprint my mark upon the world,
whatever I shall become.

Eve Merriam

DREAMS

Hold fast to dreams
For if dreams die
Life is a broken-winged bird
That cannot fly.

Hold fast to dreams
For when dreams go
Life is a barren field
Frozen with snow.

Langston Hughes

"Thumbprint" (c) 1964 by Eve Merriam. From It Doesn't Always Have to Rhyme, by Eve Merriam. Used by permission of Atheneum Publishers.
"Dreams" Copyright 1932 by Alfred A. Knopf, Inc., and renewed 1960 by Langston Hughes. Reprinted from The Dream Keeper, by Langston Hughes, by permission of the publisher.

SALMON

WAKING EARLY SUNDAY MORNING

O to break loose, like the chinook
salmon jumping and falling back
nosing up to the impossible
stone and bone-crushing waterfall --
raw-jawed, weak-fleshed there, stopped
by ten
steps of the roaring ladder, and then
to clear the top on the last try
alive enough to spawn and die.

Excerpt from "Waking Early Sunday Morning" reprinted with
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the Ocean by Robert Lowell. Copyright (c) 1965 by Robert
Lowell.

INTRODUCTION

The life cycle of the Pacific coast salmon provides a dramatic contrast to the human life cycle. During their first year, salmon travel from the streams of their birth to the ocean. Four or five years later they return to the same streams where they were born. All of this they do without ever having seen adult salmon performing the same behaviors. For after laying and fertilizing as many as 6,000 eggs, the adult female and male die. There is no time when the young fingerlings are dependent upon the adult salmon.

At birth the salmon must be able to perform behaviors that will help it survive. It must be able to find food; it must be able to swim; it must be able to recognize the smell of its homestream; it must be able to jump waterfalls. Without these behaviors and others, it would not survive. Most of the fish that begin life when the sperm fertilizes the eggs do not survive to reproduce. On the average, only two fish will survive to reproduce from the 6,000 eggs laid and fertilized.

As human beings, we seldom question that long period when we are dependent upon adults. We are born helpless, and during our long period of dependency, we learn how to behave in our various worlds. What each child learns depends upon his family and his society. A child brought up in a city is learning different things from a child brought up in the country. An African child learns different things from a European or an American child. The children in our classrooms are learning the actions, thoughts and feelings of their society--from the things they do, from parents, from teachers and from other children.

Man's dependency on a previous generation and his tremendous capacity to learn contrast with the salmon's complex behavior patterns, which are

carried on without training and with little variation from one generation to the next. We can assume that this life style, based primarily upon innate reactions rather than learning, is adaptive for the salmon species because the species continues to survive. But an individual salmon has little choice in its lifetime. If it is not born with appropriate behavior, it dies. If its homestream is blocked, it cannot decide upon an alternate route. The survival of the salmon species is dependent upon the few fish that survive to reproduce from the many thousands of eggs laid and fertilized.

Human beings have few offspring, and most of them survive to reproduce. An individual is protected from birth, and is taught and learns that he has choices within the limits of his society.

Bibliography

See the bibliography in A Guide to the Course for publication information about these books and for additional titles.

FOR THE CLASSROOM:

Selsam, Millicent, Animals as Parents
The Courtship of Animals
How Animals Live Together
The Language of Animals

FOR THE TEACHER:

* Tinbergen, Niko, and the Editors of LIFE, Animal Behavior

Most highly recommended for general background during the first half of the course. The text is excellent, and children will enjoy the pictures. If you buy any book, buy this one.

* Books essential for classroom library.

Salmon Lessons

- A. ANIMAL ADAPTATION (1 day) 32
In this lesson, the booklet Animal Adaptation is used to discuss the relation between an animal's structures and behaviors and its environment.
- B. LIFE CYCLE OF THE PACIFIC COAST SALMON (1 day) 35
After the life cycle of the salmon is introduced, questions concerning the causes of salmon behavior are brought up.
- C. EXAMINING THE BEHAVIOR OF SALMON (1 day) 39
This lesson examines specific behaviors and asks the children to consider how these innate behaviors are beneficial to the species.
- D. LIFE CYCLE VARIABLES (1 day) 45
The life styles of salmon and of humans are contrasted and questions about human learning are raised.
- E. INFORMATION AND BEHAVIOR (1 day) 48
In this lesson, the booklet Information and Behavior examines the relationship between the needs of an animal, the information it receives from its environment, and its behavior.
- F. OTHER ACTIVITIES AND QUESTIONS (3 days) 50
These are suggested for independent activities, homework or evaluation.

The time allotted for "Other Activities and Questions" includes not only time for the suggestions in that topic, but also time for your class to visit zoos, observe animals, work on related projects in art and science, as well as extra time you would like to spend on any lessons in the section.

Before teaching these lessons, please read "The Study of Animals" in Talks to Teachers and the entire Salmon unit (through page 62 of this manual).

A. Animal Adaptation

1 DAY

In the "Man and Other Animals" section of the course, there are six booklets that present ideas applicable to all animals. These booklets, interspersed throughout the study of specific animals, are: Life Cycle, Animal Adaptation, Information and Behavior, Innate and Learned Behavior, Natural Selection and Structure and Function.

Animal Adaptation looks at the way an animal is built and the way it behaves to see what purposes these structures and behaviors serve in the animal's life. Those animals whose structures and behaviors allow them to survive and reproduce are adapted to their environments.

Booklet, <u>Animal Adaptation</u>	One slide or picture of animals Optional: other pictures of animals (African animal books, copies of <u>National Geographic</u> are good sources)
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1. DEFINING STRUCTURE AND BEHAVIOR

Before reading the Animal Adaptation booklet with the children, it is wise to introduce the words structure and behavior. Have the children look at a slide or a picture of an animal and discuss: What structures does the animal have? Does it have any structures on the inside of its body that we can't see? (Structure can be defined as a specific part of something, in this case, a specific part of the animal's body.)

What about behaviors -- can you think of ways this animal would act? Behavior is used to mean the way an animal acts, using its body structures. For a more complete explanation, see Niko Tinbergen's definition in "The Study of Animals," in Talks to Teachers. A giraffe, with its long neck, would eat leaves from the tops of trees; it would bend its legs as it drank water. As the children use the word behavior, they should realize that the word does not mean, in this context, doing something in a right or wrong way. They have probably heard their mothers say "Why don't you behave?" or "Behave yourself." Now they should begin to use the word without moral connotations.

2. READING THE BOOKLET

As you read the booklet with the children, ask questions about the meaning of the pictures to make certain that they understand. For instance, when reading pp. 22-23, discuss the meaning of environment: What is the environment of a fish? a bird? Discuss the questions that are raised in the last pages of the booklet.

3. EXAMINING ADAPTATIONS OF OTHER ANIMALS

After reading the booklet, ask the children to think of animals they know about. Ask one child to name a structure of his animal, and ask someone else to describe one or more behaviors that go along with it (a robin's beak: taking worms from the ground, gathering nesting materials). Then you might ask what structures help an animal perform a specific act (when a dog eats a meal, its teeth and tongue are a few of the structures that help it). Using pictures of animals, small groups of children could describe the structures and behaviors of an animal and relate these to the environment in which the animal lives.

4. EXAMINING SOME OF THE ADAPTATIONS OF MAN

Discuss some of the structures man has and some of the behaviors these make possible. For example, one human structure is the hand; it enables

man to hold onto a baseball bat and to carry groceries home. Then reverse the question and ask what behaviors man has and what structures help him perform the behaviors. For example, think about playing baseball or carrying groceries: What structures, besides hands, make these behaviors possible?

5. EXAMINING MAN'S RELATIONSHIP WITH HIS ENVIRONMENT

These questions may be used as independent work or homework. What is your environment? (Children should include the surroundings in which they live and the people who share their environment. In the second half of the course, man's environment will be extended to include his world of thought and belief.) How do your structures and behaviors help you survive in your environment? How would your behavior change if you moved to a very hot place? a very cold place?

Some children might also want to discuss physical disabilities such as broken legs or poor eyesight. In other animals, these disabilities would probably make it impossible for the animal to survive. Yet a man with such disabilities would probably live. What makes this possible? (Men, dependent upon other men, are able to share knowledge, to ask for and offer help.)

B. Life Cycle of the Pacific Coast Salmon

1 DAY
(or 2 days if reproduction is discussed at this point)

In this lesson the children begin their study of the Pacific coast salmon. The fact that the mature salmon die immediately after spawning raises questions about the nature of learning and survival. If there are no adults present to guide and teach the fingerlings, how do they know what to do or where to go?

Film, "The Life Cycle of the Salmon" (10 min., narrated)
Booklet, Salmon

Film projector
Screen

1. REVIEWING THE FILM

(A copy of the narration of this film is found at the end of the lesson.)

After viewing the film, discuss with the children any questions they may have. Review the lifetime of a salmon by drawing a life line on the board, marking off five one-year sections. Where does the laying and fertilizing of eggs appear on this line? What goes on between birth and spawning? After salmon lay and fertilize the eggs, does anything important take place before death?

Discuss the salmon's environment. What structures and behaviors do the fish have that are useful in their environment?

2. READING THE BOOKLET

Much of the booklet is a review of the information in the film. You may want to have children read it by themselves or in small groups.

If questions about the meaning of fertilization come up, you should make available dittoed copies of the sheets entitled "Mating and Fertilization" at the end of this manual. The children can read the sheets independently and discuss them at another time.

TRANSCRIPT OF NARRATION: THE LIFE CYCLE OF THE SALMON
(10 minutes, narrated)

From the lofty mountains of western North America many a cold clear river flows swiftly to the sea...fed by icy streams from snowbanks high on mountain slopes...fed by melting glaciers and by clear forest springs.

Water seeps from the deep moss and rotting wood of the ancient forest, spills over the rim of beaver dams, gathers in running brooks, slides swiftly downward in valley streams, and finally courses in the steady flow of river driving to the sea.

Each year out of the great Pacific Ocean millions of salmon enter the cold flood of the mountain waters.

Upstream the salmon swim, mile after mile, toward the headwaters where they will spawn. Unerringly each adult salmon moves toward the stream in which it was born. Up rapids, up waterfalls impassable to all but the mighty salmon, each fish is driven by an urge to return to the stream where it spent its days as a fingerling years before.

Some rivers are impassable even for salmon. But these the salmon ignore, for they are not ancestral streams. Each mountain stream has its own special odor. And it is this distinctive odor that guides the returning salmon. This river is completely filled with salmon. So enormous are their numbers that the river could not possibly supply their food; but stored in the body of each fish is enough food for this last great journey.

On the big rivers some fish will travel as much as a thousand miles upstream before they reach the spawning grounds, often battling for each foot of progress. Indeed, some never reach the spawning grounds.

Among the rocks and shoals of the mountain streams a humped salmon twists and turns in search of open passageways.

Journey's end at last. The salmon rest above the gravelly stream bed while within their bodies the eggs ripen. These are king salmon. Like all salmon the female digs her nest by lying on her side and slapping. By this vigorous action she flushes away the sand from among the pebbles, thus leaving openings and crevices between the stones to receive the eggs.

Here, a pair of dog salmon prepares for spawning. As the female digs the nest, the male stays nearby.

Soon the male quivers with excitement until the spray flies from his back.

By strenuous flapping the female raises the sand and tiny pebbles from the stream bed, and the current carries them clear of the nest.

As the fish continue to work and fight without food, they slowly waste away. Their skins turn white; their fins disintegrate. As they prepare to sow the seeds of another generation, their own lives are nearly at an end.

With her mouth open the female in the center drops the eggs, and the males on either side fertilize them. The eggs fall gently to the nest prepared for them among the pebbles.

Then the female stirs the stream bed again, and gravel sifts down to cover the eggs and hide them from trout and other predators. She continues to make nest after nest until she has laid several thousand eggs.

The purpose of the journey is achieved, and the energy within the body of the parent is exhausted. Helplessly, it drifts downstream, its life over. No salmon on the Pacific coast ever survives to spawn a second time. But the dead salmon leave behind them millions of eggs buried in the gravel, the new salmon waiting to be born.

Here in the stream bed the eggs will develop slowly through the winter. First, the eyes appear as little black specks joined together by blood vessels. Now the dim outlines of a fish appear, a small red dot beneath the throat grows and beats, the tiny heart stirring into life.

The growing embryo struggles inside the egg. At last the tail breaks through the membrane, and the young fish emerges with the yoke sac still attached to its body. During the weeks of the cold weather the bones, fins and tissues develop, nourished by the food stored in the yoke.

With the coming of spring the water furnishes new food in the form of microscopic plants and animals. Now the young salmon grow rapidly, living in the stream at first, and later in the great ocean.

Some salmon will survive the journey to the coast and the years at sea, and they will return, their great bodies stored with flesh built from the rich food in the ocean. They, in turn, will travel up the stream where they were born and found another generation.

C. Examining the Behavior of Salmon

1 DAY

(Children can explain the displays they make during odd moments on following days.)

How do salmon find their way to their homestream? Why do they return to their homestream? Why is it advantageous for salmon to return to the same place at the same time as other salmon?

These questions and others are raised in this lesson. As they answer some of them, the children consider the causes of behavior -- What makes the fish act the way it does? As they answer other questions, the children think about the advantage of the behaviors for the survival of the salmon species.

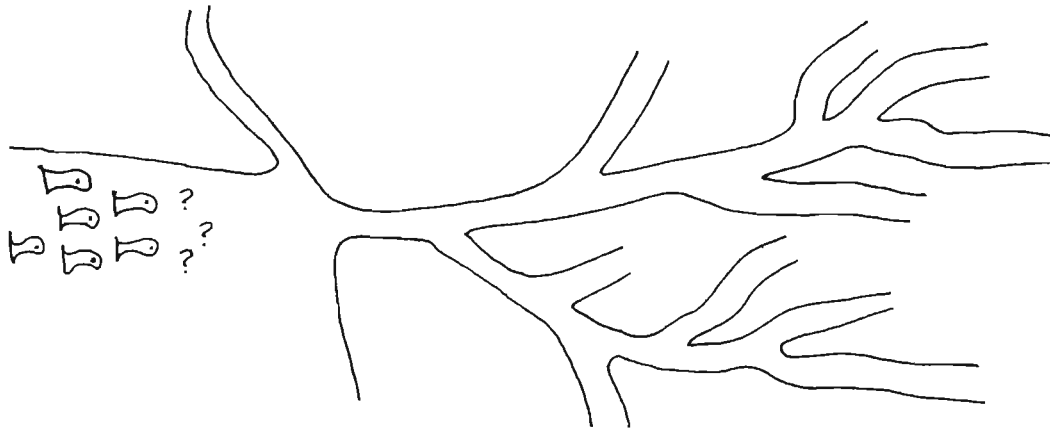
Salmon Problem Sheets (sets of four worksheets
to be prepared by teacher)
Paper to make charts and diagrams

1. DISCUSSING THE RETURN TO THE HOMESTREAM

First, discuss with the children the advantages of the salmon's return to its homestream to mate. The homestream is a quiet, tranquil spot -- certainly quieter than the rushing streams and turbulent oceans. Here, the fertilized eggs can develop without as many predators as there would be in other areas. And the young fish can find food without as many competitors for the same food supply as there would be in the ocean.

2. RAISING PROBLEMS THE SALMON FACE

Then ask the children what problems the salmon face as they travel upstream. A sketch on the board will help them visualize the difficulties.



Some of the questions the children -- or you -- should raise are:

With all the possible tributaries, how do the salmon know which to follow?

Why don't they jump onto land since they jump over waterfalls?

Many salmon must end up at the same place so that there will be many males and females together and mating can occur. How is it that many salmon do go to the same spot?

By the time the salmon arrive at their destinations, they are exhausted and will soon die. How does it happen that enough salmon return to the homestream at the same time so that they can mate before they die?

3. DISTRIBUTING WORKSHEETS

Distribute the worksheets that have been dittoed from the next four pages, explaining that they describe problems the salmon faces when it travels upstream. Since there are four different sets, you should break your class into four groups, giving each person a copy of his group's worksheet. On each sheet, there are several questions to be discussed by the group and then answered individually, and one problem that can be done by the group working together.

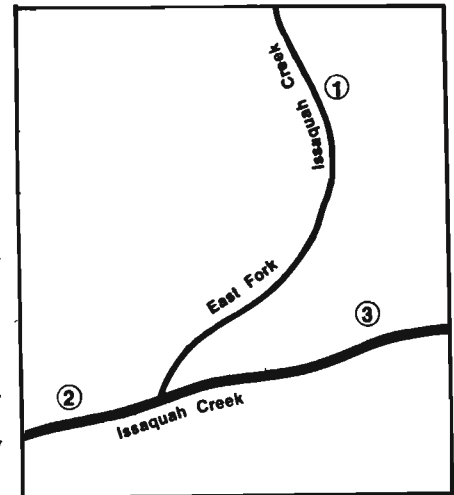
4. HOMEWORK ASSIGNMENT

Give each child a worksheet he did not work on during class. Tell the children to omit the question about explaining the problem to the class.

How do salmon find their homestreams?

Every time a tributary branches off a river, the salmon must make a choice. How does the salmon find the one tributary that leads to its homestream?

Many experiments have shown that a salmon's sense of smell is strong. Arthur Hasler, a scientist studying salmon behavior, did an experiment to find out whether a salmon's sense of smell had anything to do with its choice of which tributary to follow. Each tributary has a slightly different chemical odor. This is because the chemical make-up of the small streams that feed one tributary is different from the chemical make-up of the streams that feed any other tributary.



THE EXPERIMENT

- A. Three capture stations were set up on a river with a tributary.
- B. Seventy-six salmon were caught as they were swimming upstream at 1 on the map. These salmon were returning to the homestream. If they were taken back to 2 on the map, they should all return to 1, because this was the way to their homestream.
- C. The nostrils of about half the fish were closed with plugs, and these fish were marked. The other fish were marked, but nothing was done to their sense of smell. The scientists would then be able to compare the behavior of the two groups of fish.
- D. Both groups of salmon were released at 2 on the map. This means that as they swam back upstream, they could go up either the Issaquah Creek or the East Fork of Issaquah Creek.
- E. Fish were recaptured at 1 and 3 on the map. Of the fish that had not had their nostrils plugged, almost all returned to the trap at 1. But only one-fourth of the fish with their nostrils plugged returned to the trap at 1.

WHAT INNATE ABILITY OF SALMON HELPS THEM FIND THE HOMESTREAM?

WHAT INFORMATION IS NECESSARY FROM THE ENVIRONMENT?

USING CHARTS OR DEMONSTRATIONS, EXPLAIN HASLER'S EXPERIMENT TO YOUR CLASSMATES.

WHAT DID HASLER FIND OUT FROM THIS EXPERIMENT?

How do salmon stay in the water?

How do they leap waterfalls?

Before they start upstream, salmon have never swum against currents. They have never jumped waterfalls or fought their way through shallow water. Their main problem is to stay in the water as they force their way upstream.

The salmon's solution to this problem is to swim against the current where the current is swiftest. This is a useful behavior. It means that salmon are always swimming toward more water upstream. If a salmon comes to a large rock over which no water flows, it swims around the rock to follow the flow of the water.

To jump a waterfall, salmon go to the spot where the most water is falling. This is a more difficult jump, perhaps, but a safer one.

Salmon aim at the top of a waterfall by sight. Swimming toward it, the salmon can see the sun shining on the top of the waterfall, and they jump toward this bright light. During the evening and on cloudy days, salmon do not leap.

A salmon can leap several times its height. It does this by letting the river help. Water coming over the waterfall plunges deep, then rises rapidly to the surface. As salmon approach waterfalls, they dive deep until they reach the upward-moving water. With the water giving an added push, the salmon leap.

WHAT PREVENTS THE SALMON FROM JUMPING OUT OF THE RIVER ONTO THE BANKS?

WHAT STRUCTURES DO SALMON HAVE TO HELP THEM LEAP WATERFALLS?

COULD THE SALMON HAVE LEARNED TO LEAP A WATERFALL?

WHAT INFORMATION FROM THE ENVIRONMENT HELPS THEM LEAP THE FALLS?

DRAW A DIAGRAM OF WATER FLOWING OVER A WATERFALL OR AROUND A ROCK. SHOW HOW THE SALMON USES THE INFORMATION IT RECEIVES.

Why do salmon return to their homestream to spawn?

Salmon can no longer travel on many of the rivers they once used, because dams have been built across them or because the rivers have become polluted.

When scientists know something is going to happen to a river that salmon usually travel, they try to think of ways to save the future generations of the fish. One thing they do is move newly laid eggs to safer rivers. The salmon developing from these eggs will return five years later to the new river bed to lay their eggs.

Once when scientists moved eggs to a river they thought would be safer, they created a new problem. Usually only a few hundred salmon return to reproduce at the spot where many thousands of eggs were laid. But this river bed was especially safe, and hundreds and hundreds of salmon returned, more than the river could hold!

WHAT CAUSED THE SCIENTISTS' PROBLEM?

WHY IS IT AN ADVANTAGE TO THE SALMON SPECIES THAT SALMON RETURN TO THEIR HOMESTREAM TO REPRODUCE?

WHAT WOULD A SALMON DO IF ITS RIVER WERE BLOCKED?

IMAGINE THAT A LARGE DAM IS GOING TO BE BUILT ACROSS A RIVER THAT SALMON USUALLY TRAVEL. DESIGN A WAY FOR PART OF THE DAM TO BE BUILT SO THAT THE SALMON CAN CONTINUE THEIR JOURNEY.

Why do salmon of the same age return to their homestreams together?

Scientists moved a batch of fertilized salmon eggs to a new river bed that was already used by salmon. They knew that the parents of the eggs they had moved traveled upstream at a different time of the year than parents of the eggs that were originally in the stream.

About five years later all the salmon returned to the river bed where the new eggs had been placed. But they returned at different times of the year. Each group of salmon went upstream to reproduce at the time of the year their parents had gone upstream five years earlier.

THIS EXPERIMENT SHOWS THAT SALMON RETURN TO THE STREAM OF THEIR BIRTH. WHAT ELSE DOES IT SHOW?

WHAT WOULD HAPPEN TO THE SALMON SPECIES IF SALMON BORN AT THE SAME TIME RETURNED TO THEIR BIRTHPLACE AT DIFFERENT TIMES OF THE YEAR?

WHAT ADVANTAGE IS IT TO THE SALMON SPECIES THAT ALL SALMON BORN AT THE SAME TIME IN A PARTICULAR STREAM RETURN TO THAT STREAM AT THE SAME TIME?

DRAW A CARTOON OF A SALMON ARRIVING AT ITS BIRTHPLACE AND FINDING NO OTHER SALMON THERE.

D. Life Cycle Variables

1 DAY
(or 2 days if children are given
class time to do individual projects)

This lesson focuses on several aspects of the life cycle that determine the life history of an individual of a species. The children examine these facts for salmon and for man, and they may do research to find the information for other animals.

Life cycle chart (prepared before class) for bulletin board
Notebook-size charts (to be dittoed before class)
Optional: Animal Studies

1. FILLING OUT CHART

Fill out a chart with your class of facts about the life cycles of the salmon and the human being. It is a good idea to make this a large chart on the bulletin board that can be expanded gradually as the children add similar information about other animals. The completed chart for man and the salmon might look like this:

	Length of lifetime	Length of dependency	What parents do for survival of young during dependency	Number of offspring in female lifetime	Number that survive to reproduce
Man (in U.S.A.)	about 70 years	15-20 years	protect; provide food & clothing; provide time and opportunity for learning; teach	about 4	about 3
Salmon	about 5 years	none	nothing	5,000-6,000	about 2

While you are filling in the chart, discuss with the children the meaning of the different categories. Consider particularly the meaning of dependency.

The numbers that are put on the chart are, of course, approximate. For humans, some of the variables differ from culture to culture. Thus, Americans may have an average lifetime of 70 years and Eskimos a much shorter lifetime. Likewise, number of offspring differs not only from culture to culture but from family to family.

2. QUESTIONS ABOUT THE CHART

When the chart is completed, the class can consider the relationships among variables by discussing some of the following questions:

What seems special about the salmon lifetime? the human lifetime?

What happens during the long period of human dependency?

What are you learning? Are people all over the world learning the same things?

What is a human infant like at birth? a salmon?

What difficulties does this long time of learning cause for a human? What advantages come from it? (Encourage comments that lead toward an awareness of man's power of choice and his inventive ways to solve problems.)

If there is no parental care, and many offspring die in the process of growth, do you think each female would have to produce a greater or fewer number of offspring for the species to survive?

Man's population is increasing. Why is this so? What problems is he making for himself?

As long as there is at least one offspring that survives to reproduce for each adult that dies, a species will survive. The individuals of some species raise only a few offspring in a lifetime. And most of their offspring have to reproduce in order for that species to survive. Is this true for man?

3. HOMEWORK ASSIGNMENT

You might have the children use the Animal Studies to look up information about the life cycles of other animals. They may use their

notebook-size charts to enter the information they have found, and then it can be entered on the bulletin board chart. This will give the class more data with which to explore the relationships among events in the life cycle.

E. Information and Behavior

1 DAY

This is the second booklet that focuses on an idea applicable to all animals.

As the children read the booklet, they should see that there is a relationship between an animal's needs and the information it receives from its environment. Sometimes an animal receives information and this stirs a feeling in its body that causes it to act. Sometimes it has a need and searches for a way to satisfy the need.

This is a good time to observe animals at home, or in the classroom, looking particularly for needs the animals have and ways in which they receive and act on information.

Booklet, Information and Behavior

Paper for cartoons

1. READING THE BOOKLET

The questions suggested below are a few you might pose as you read the booklet with your class.

Pages 2-7: Discuss what is happening in the pictures in relation to the text.

8-13: How are the animals in these pictures gathering information? How do you receive information? In what ways do you act when you receive information (like a pin-prick or a sniff of roses)? How about hearing -- what do you hear when you wake up in the morning or at any other time of the day? How do the things you hear influence the way you act? (These questions could be made into a homework composition assignment.)

Pages 14-19: Discuss the questions raised in the booklet.

20-25: What information do you get from the environment that stirs up feelings inside you? How do you act?

26-31: How does the behavior of individual animals influence the survival or death of the species?

32-35: Discuss the meaning of the pictures.

36-47: Discuss the meaning of the arrows in the pictures.

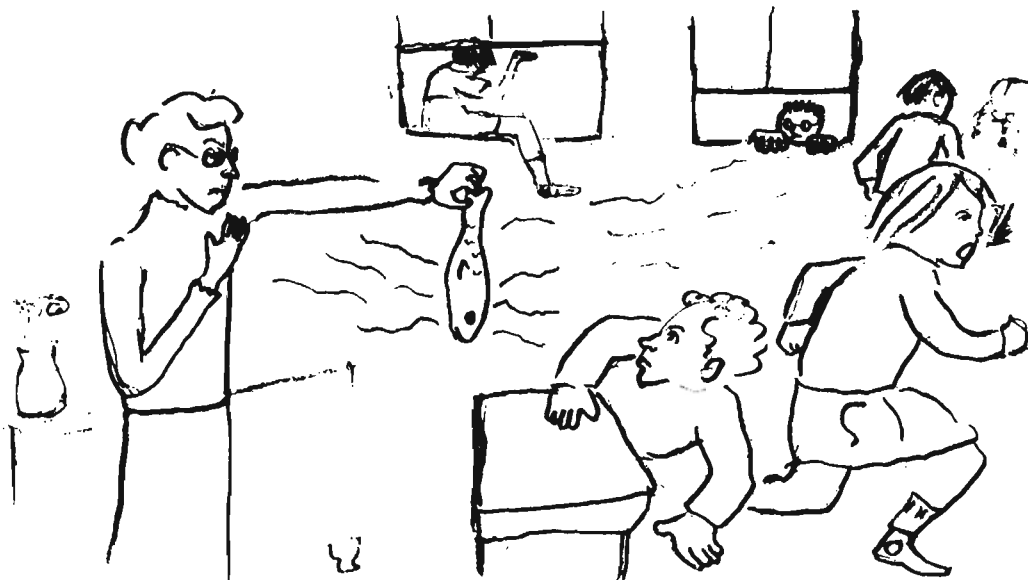
48: As the children look at the picture of the human brain, they can find the areas on their own heads where the various parts of the brain are located.

2. MAKING CARTOONS

With the class, draw a cartoon like the one below, showing a human being receiving information from the environment and acting on it. What information is being received? How? What behavior does it cause? Encourage the children to make their own cartoons, showing a person or another animal receiving information and acting on it.

3. RESEARCHING OTHER ANIMALS (OPTIONAL)

If the children have read Animal Studies as homework, have them describe the needs of the animal they have studied, the way it gets its information, and its behavior.



Children may be interested in observing the structures of a dead fish.

F. Other Activities and Questions

(Time allotted as
necessary)

Activities

1. While they are studying salmon, the children might enjoy drawing a mural of a salmon's life. After they have finished the mural, they might label and describe the different parts of the journey. This might be done during art period.

2. To emphasize the relationship between structure, behavior and environment, individual assignments or a classroom activity can be built around this chart:

SALMON		
Ways it behaves	Structures that help it behave the way it does	The way the behavior helps the salmon in its environment
1. Swimming 2. Going upstream 3. Digging nest 4. 5. (etc.)		

3. Bring a dead fish into class and point out its external structures. Some classes have then dissected the fish and examined the internal structures and the skeleton.

Questions for homework or evaluation

1. Even though salmon die immediately after laying and fertilizing the eggs, there are some things the adults do that protect the young. What are they?

2. What are three or four important things that a salmon receives information about from its environment? How does it receive the information? What are three or four important things that you receive information about from your environment? How do you receive the information? Which senses seem to be most important to the salmon? Which ones seem most important to you?

Though all (animals) share one world, all may be said to live in different worlds, since each perceives best only that part of the environment essential to its success. Thus, how an animal behaves has much to do with what its sense organs are and whether these are few or many, simple or complex.

Tinbergen, Animal Behavior, p. 45

3. Why is it necessary for the salmon to have a good sense of smell? Why is it necessary for man to have keen eyesight? Because one animal has a sense more keenly developed than another animal, it does not mean that it is more intelligent: it means that the sense has been an advantage to that animal in adapting to a particular environment.

4. The following information interests many children. You may want to make it available for them.

HOW DOES A SALMON FIND THE MOUTH OF THE RIVER TO START ITS TRIP UPSTREAM?

Scientists agree that salmon probably use the smell of their own stream to find their way up the river from the ocean, but how do they find that one river out of the hundreds of rivers that empty into the ocean? After four years of traveling thousands of miles, how do they find the spot to begin their final journey?

Some scientists think that a part of the salmon's body responds to the angle of the sun's rays. The sun's rays slant at different angles depending on the time of year and where the sun is in the sky. According to these scientists, adult fish begin to use the slant of the sun's rays as a clue from the environment to find their way back to the mouth of the river. Something in the salmon's body responds to something outside its body, and it is guided back to the mouth of its river.

DO ALL SALMON BEHAVE THE SAME WAY?

Atlantic salmon return to their homestreams to mate, just as Pacific salmon do. Both kinds make their journey after five years in the ocean. But some Atlantic salmon return to the ocean after they mate and live to make a second journey upstream. A few even live to make a third journey, and a very few make a fourth.

The journey up the river is difficult, and neither the Pacific salmon nor the Atlantic salmon eat as they go upstream. But many of the rivers flowing into the Atlantic are shorter than the rivers flowing into the Pacific. The Atlantic salmon do not have so far to travel either up the river to spawn or back to the ocean with its rich store of food.

Reproduction Information

During the life cycle lessons at the beginning of Man: A Course of Study the subject of reproduction is introduced. Each of the animal studies takes up the topic again.

Reproduction is the way life maintains itself. Most animals and plants reproduce sexually; that is, the male reproductive cell (the sperm) unites with the female reproductive cell (the egg) to form a new individual. We call the process of union fertilization. Sexual reproduction involves mating, fertilization, embryonic development, and birth.

It is helpful to have live animals, such as grasshoppers, mealworms, crickets, gerbils or mice, in the classroom when discussing reproduction. As the children note the various stages of an animal's lifetime, including the birth of offspring, questions emerge and can be answered directly and immediately. The grasshopper is a particularly good animal to observe. The male and female are easily identifiable, and the children can see the male mount the female, the female lay eggs, and the eggs develop.

On the following pages are two sets of information sheets that can be dittoed or mimeographed for children. The first concerns mating and fertilization. This set should be made available during the first several weeks of the course. The second set concerns genetics. This subject is terribly complex and is not necessary for an understanding of the course. If, however, there are children in your class who are particularly interested in how characteristics are passed down from parent to offspring, you may want to make these sheets available.

Bibliography

See the bibliography in A Guide to the Course for publication information about these books.

CHILDREN'S BOOKS:

Cosgrove, Margaret, Eggs and What Happens Inside of Them

Gruenberg, S. M., The Wonderful Story of How You Were Born

Levine, Milton, and Jean Seligmann, A Baby Is Born

This book is written for six- to ten-year-olds and may seem too simple to fifth graders. But it is informative and contains helpful diagrams of the male and female body.

Randall, Judith, All About Heredity

An introduction to the science of genetics, from Mendel's first experiments with garden peas to the latest discoveries about DNA.

- * Sherman, Diane, "Blueprints Inside of You," reprinted from Nature and Science (vol. 4, no. 13, March 27, 1967) and available, for 25¢, from:

Nature and Science
The Natural History Press
Garden City, New York 11531

BOOKS FOR TEACHERS

A Baby Is Born (Maternity Center Association, New York)

A picture story of a baby from conception to birth.

Flanagan, Geraldine, The First Nine Months of Life

Parts of this book, which is written for adults, could be read aloud to children. Contains pictures of the development of the human embryo.

*Especially recommended.

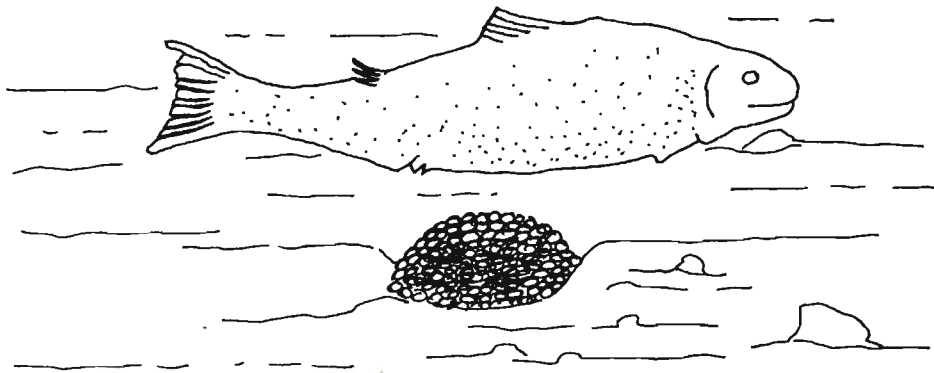
MATING AND FERTILIZATION

We know that living things must die. Yet life goes on and on. This happens because living things are able to reproduce themselves.

For most living things to reproduce, a cell from a male animal must join a cell from a female animal. The female animal produces tiny cells called eggs. The male animal produces tiny cells called sperm. When the animals mate, an egg and a sperm come together. The tiny cell that is formed when the egg and sperm come together is the beginning of a new life, a new individual.

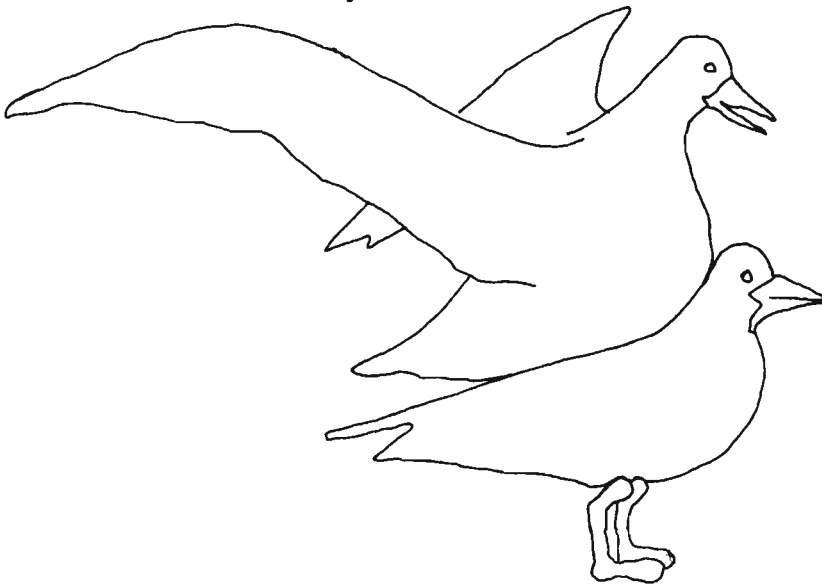
When the sperm joins the egg, we call the process fertilization.

In some animal groups, fertilization takes place outside the body and the offspring develop outside the body. The female lays the eggs. Then the male fertilizes them. If the male does not fertilize them, the eggs will not develop.



In this picture, a male salmon is swimming over the eggs that the female has just laid. He will spray them with a milky-colored substance that contains the sperm. When a sperm unites with an egg, a new fish begins to develop.

In other animal groups fertilization takes place inside the female's body, but the new individual develops outside the female's body. The sperm cells of the male herring gull unite with the egg cells of the female gull inside the female's body. After hard, protective shells have formed, the female lays the eggs and the chicks develop outside the female's body.



In this picture, a male gull is mounting a female. The sperm will pass from his body through a passage under his tail. It will enter the female's body through a passage located under her tail. The sperm will unite with the eggs inside the female's body.

In still other animal groups, fertilization takes place inside the female's body and the new individual develops inside the female's body. This is true of dogs, cats, baboons, humans -- almost all mammals. The sperm cell unites with the egg cell inside the body of the female and the new individual begins to grow inside the female's body. As the individual grows, it is nourished by food from its mother's body. A dog grows for two months in its mother's body, a baboon for six months, and a human being for about nine months before being born.

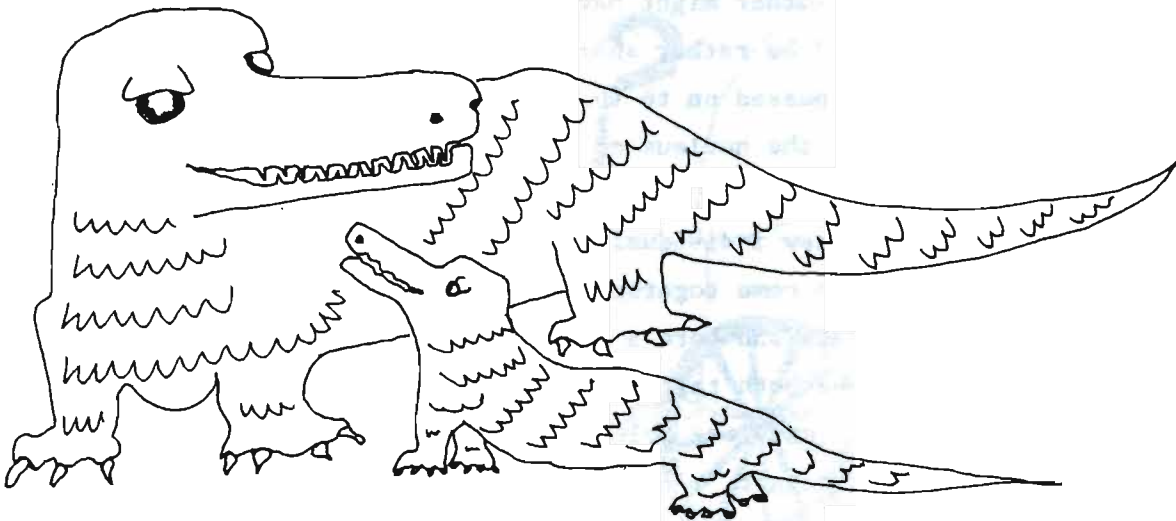
Most animals that develop in the body of the female are born almost helpless. The first nourishment they receive after they are born is milk from their mother. They spend the first part of their lives being dependent upon her for food and protection.

HOW YOU BECOME YOU AND A CROCODILE BECOMES A CROCODILE

All of us inherit characteristics from our parents. You are the only person like you, but you look a little bit like your father and a little bit like your mother. Sometimes you may respond to something the way your father would, sometimes like your mother.

How are these characteristics passed down?

You know that the life of any individual begins when an egg cell is fertilized by a sperm cell. In these tiny cells are the bits of information that will make you grow up to have the characteristics of your parents, and will make a crocodile grow up to have the characteristics of its parents. The characteristics are passed down from parent to offspring through genes. Genes can be found in the center, or nucleus, of the sperm and egg cells.



Think for a moment about human reproduction. When the sperm enters the egg, the centers of the two reproductive cells come together and their content is combined. When this happens, a fantastic number of characteristics of the new baby are decided upon. Some of the characteristics will be the same for any member of the human species. Others will make the baby be like no other baby in the world. Will it be a boy or a girl? Will its eyes be brown or blue? What will be the shape of its face and body? Will it be tall or short, healthy or likely to get diseases? These are just a few of the thousands of things that are decided about the new individual in the first half an hour after the egg and sperm unite.

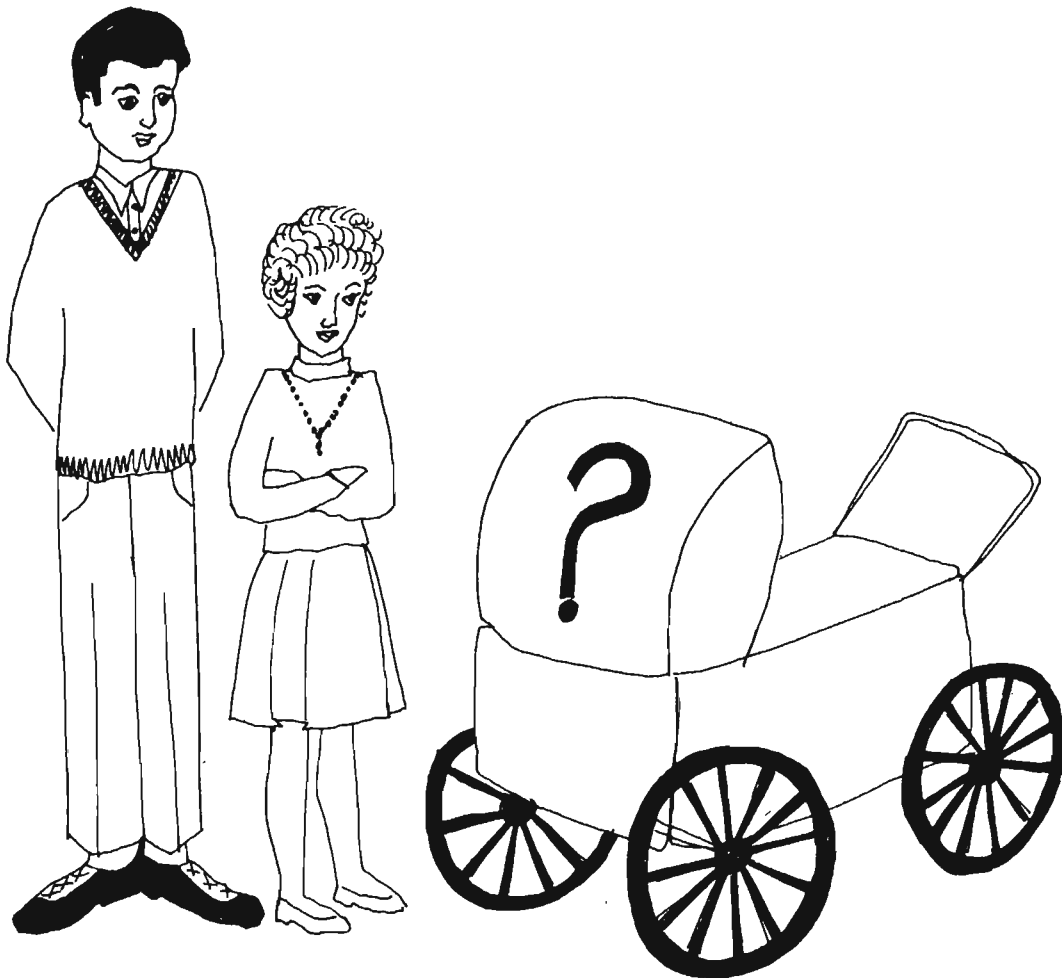
The sperm of the father carry the characteristics of the father. For instance, a human father might have brown hair and a round face, and be very tall. These characteristics are all passed on to the offspring through the genes in the nucleus of the sperm.

A human mother might have red hair and a narrow face, and be rather short. These characteristics are all passed on to the offspring through the genes in the nucleus of the egg.

But the new individual that is formed when the egg and sperm come together cannot have both red and brown hair and both a round and narrow face, and cannot be both tall and short. The new individual can have only one color of hair, one shape of face, and one height.

When the male and female genes for the color of eyes come together, one of the genes controls the other. In this case, the gene with the characteristics for brown hair might control the gene with the characteristics of red hair. We say that the stronger gene is dominant over the weaker gene.

The way you look (and in part, the way you act) is the result of a combination of genes from your parents. And since your parents carry characteristics from their parents, you may also resemble your grandparents, or great-grandparents.



Many men are studying genes to understand how characteristics are passed down. It is a very complicated and exciting subject. If it interests you, you may want to read an article called "Blueprints Inside of You." You can get this article by writing to:

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Send them 25¢ and ask for the advance edition, volume 4, number 13, March 27, 1967.