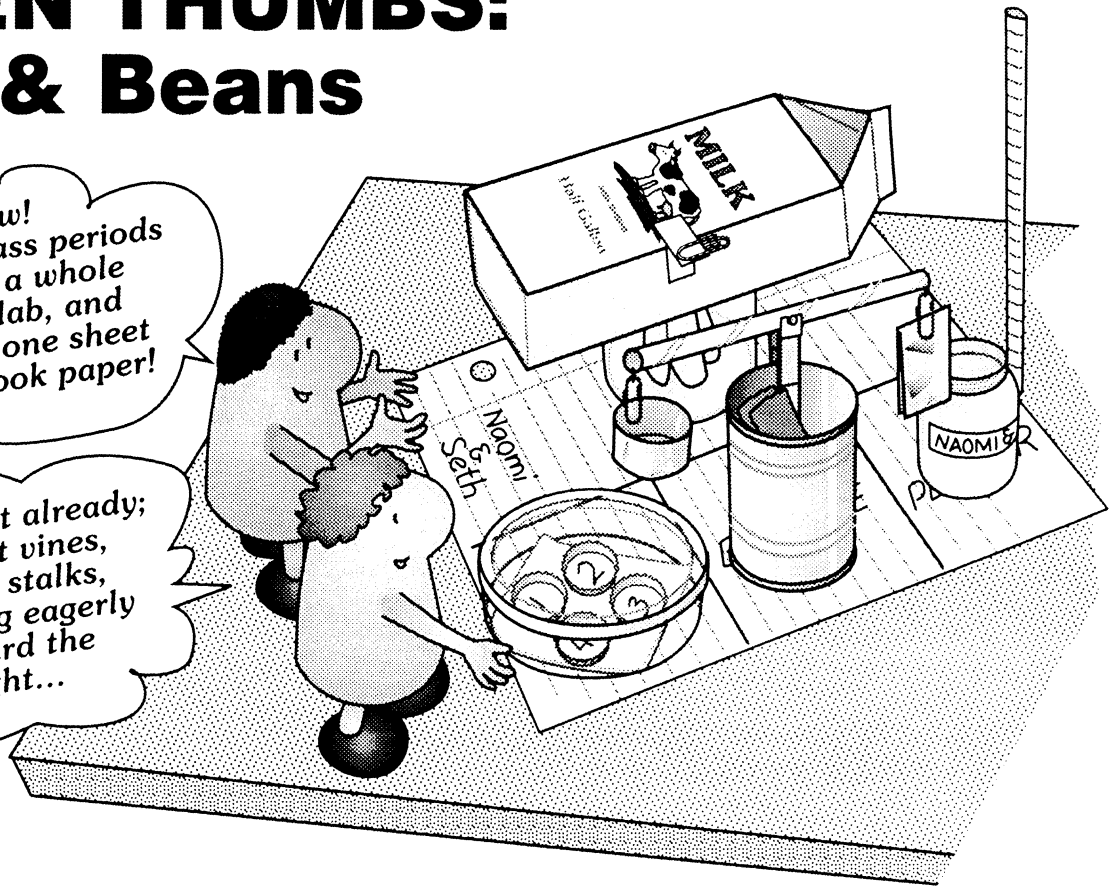


GREEN THUMBS: Corn & Beans

Wow!
In just 4 class periods
we built a whole
botany lab, and
it fits on one sheet
of notebook paper!

I can see it already;
verdant vines,
sturdy stalks,
reaching eagerly
toward the
light...



SCIENCE WITH SIMPLE THINGS SERIES

Conceived and
written by
RON MARSON
Illustrated by
PEG MARSON

TOPS
LEARNING SYSTEMS

"SCIENCE WITH SIMPLE THINGS!"

website: www.TOPScience.org
email: tops@canby.com
customer service: (503) 263-2040
home office: (503) 266-8550

WHAT CAN YOU COPY?

Dear Educator,

Please honor our copyright restrictions. We offer liberal options and guidelines below with the intention of balancing your needs with ours. When you buy these labs and use them for your own teaching, you sustain our work. If you “loan” or circulate copies to others without compensating TOPS, you squeeze us financially, and make it harder for our small non-profit to survive. Our well-being rests in your hands. Please help us keep our low-cost, creative lessons available to students everywhere. Thank you!

PURCHASE, ROYALTY and LICENSE OPTIONS

TEACHERS, HOMESCHOOLERS, LIBRARIES:

We do all we can to keep our prices low. Like any business, we have ongoing expenses to meet. We trust our users to observe the terms of our copyright restrictions. While we prefer that all users purchase their own TOPS labs, we accept that real-life situations sometimes call for flexibility.

Reselling, trading, or loaning our materials is prohibited unless one or both parties contribute an Honor System Royalty as fair compensation for value received. We suggest the following amounts – let your conscience be your guide.

HONOR SYSTEM ROYALTIES: If making copies from a library, or sharing copies with colleagues, please calculate their value at 50 cents per lesson, or 25 cents for homeschoolers. This contribution may be made at our website or by mail (addresses at the bottom of this page). Any additional tax-deductible contributions to make our ongoing work possible will be accepted gratefully and used well.

Please follow through promptly on your good intentions. Stay legal, and do the right thing.

SCHOOLS, DISTRICTS, and HOMESCHOOL CO-OPS:

PURCHASE Option: Order a book in quantities equal to the number of target classrooms or homes, and receive quantity discounts. If you order 5 books or downloads, for example, then you have unrestricted use of this curriculum for any 5 classrooms or families per year for the life of your institution or co-op.

2-9 copies of any title: 90% of current catalog price + shipping.

10+ copies of any title: 80% of current catalog price + shipping.

ROYALTY/LICENSE Option: Purchase just one book or download *plus* photocopy or printing rights for a designated number of classrooms or families. If you pay for 5 additional Licenses, for example, then you have purchased reproduction rights for an entire book or download edition for any 6 classrooms or families per year for the life of your institution or co-op.

1-9 Licenses: 70% of current catalog price per designated classroom or home.

10+ Licenses: 60% of current catalog price per designated classroom or home.

WORKSHOPS and TEACHER TRAINING PROGRAMS:

We are grateful to all of you who spread the word about TOPS. Please limit copies to only those lessons you will be using, and collect all copyrighted materials afterward. No take-home copies, please. Copies of copies are strictly prohibited.

Ask us for a **free shipment** of as many of our **TOPS IDEAS Catalogs** as you need to support your efforts. Every catalog is a rich, attractive resource magazine packed with free sample teaching ideas.

Electronic edition 2011. Copyright ©1997 by TOPS Learning Systems. All rights reserved. This material is created/printed/transmitted in the United States of America. No part of this program may be used, reproduced, or transmitted in any manner whatsoever without written permission from the publisher, **except as explicitly stated above and below:**

The **original owner** of this book or digital download is permitted to make multiple copies of all **student materials** for personal teaching use, provided all reproductions bear copyright notice. A purchasing school or homeschool co-op may assign **one** purchased book or digital download to **one** teacher, classroom, family, or study group **per year**. Reproduction of student materials from libraries is permitted if the user compensates TOPS as outlined above. Reproduction of any copyrighted materials for commercial sale is prohibited.

For licensing, honor system royalty payments, or catalog requests, contact: **www.TOPScience.org**; or **TOPS Learning Systems, 10970 S Mulino Rd, Canby OR 97013**; or inquire at **tops@canby.com**

ISBN 978 - 0 - 941008 - 49 - 5

CONTENTS

PART I

INTRODUCTION

- A. Getting Ready
- B. Gathering Materials
- C. Long Range Objectives
- D. Gaining a Whole Perspective

PART II

TEACHING NOTES

MON/-4	TUE/-3	WED/-2	THU/-1	FRI/0
MON/3	TUE/4	WED/5	THU/6	FRI/7
MON/10	TUE/11	WED/12	THU/13	FRI/14
MON/17	TUE/18	WED/19	THU/20	FRI/21
MON/24	TUE/25	WED/26	THU/27	

PART III

REPRODUCIBLE MATERIALS

- Take-Home Test
- Lab Instructions: lab 1—11
- Journal Cut-Outs: journal 1—12

Gathering Materials

Listed below is everything you'll need to teach this module. You already have many of these items. The rest are available from your supermarket or garden store. Keep this classification key in mind as you review what's needed:

<p><i>special in-a-box materials:</i> Italic type suggests that these materials are unusual. Keep these specialty items in a separate box. After you finish teaching this unit, label the box for storage, and put it away to use again next year.</p>	<p>general on-the-shelf materials: Normal type tells you these materials are common. Keep these basics on shelves readily accessible to your students. The next TOPS unit you teach will likely use many of the same materials.</p>
<p>(substituted materials): Parentheses enclosing any item suggest a ready substitute. These alternatives may work just as well as the original. Don't be afraid to improvise, to make do with what you have.</p>	<p>*optional materials: An asterisk sets these items apart. They are nice to have, but optional. They are probably not worth an extra trip to the store, unless you are gathering other materials as well.</p>

All materials are listed in order of first use. Start gathering at the top and work down. Ask students to bring recycled items from home. Most of these materials will be used sooner rather than later, as students construct most lab equipment in the first few lessons.

Needed quantities depend on class size, and how you organize students into lab groups. Adjust your own numbers up or down as needed:

Q_1 / Q_2



Single Student: Enough for 1 student to complete all the experiments.

Classroom: Enough for 30 students when organized into 15 lab pairs.

KEY:	<i>special in-a-box materials</i> (substituted materials)	general on-the-shelf materials *optional materials
$1/30$	pairs of good, pointed scissors	
$1/3$	boxes paper clips, medium size, all the same brand	
$24/650$	sheets notebook paper — college ruled preferred, wide ruled acceptable	
$1/4$	rolls clear tape	
$1/1$	stapler	
$1/3$	spools thread	
$1/2$	rolls masking tape	
$1/15$	*metric rulers	
$2/30$	straight plastic drinking straws	
$2/45$	straight pins	
$1/15$	wooden clothespins	
$1/15$	empty cans, medium size, 14 -16 oz	
$1/1$	roll aluminum foil	
$1/15$	size-D batteries, dead or alive	
$1/1$	pkg dry pinto beans, sold in grocery stores	} a fresh supply each year ensures viability
$1/1$	pkg dry popcorn, sold in grocery stores	
$2/45$	baby food jars, medium or large size	
$4/60$	bottle caps from soft drink (or beer) bottles	
$1/15$	plastic tubs, deli or margarine	
$1/4$	rolls paper towels	
$1/15$	cardboard milk cartons (styrofoam egg cartons) — see teaching notes for MON/10	
$1/1$	water source — distribute watering bottles to avoid traffic jams	
$1/30$	*hand lenses — see teaching notes for WED/5	
$.5/8$	<i>quarts vermiculite, sold in garden and variety stores</i>	
$1/1$	jar of petroleum jelly	
$1/1$	bottle blue food coloring — use self-dispensing bottle or provide eye dropper	
$1/30$	lids from baby food jars — used as food coloring palette, and for Take-Home Test	
$1/30$	thick rubber bands	
$1/15$	*large paper grocery bags — see teaching notes for MON/-4 and THU/27	
$1/1$	* <i>bag potting soil</i> — see teaching notes for THU/27	
$1/1$	pkg dried lentils, sold in grocery stores — fresh for viability	
$1/1$	pkg wheat berries — fresh, whole grains of wheat sold in health food or farm stores	

GAINING A WHOLE PERSPECTIVE

Science is an interconnected fabric of ideas woven into broad and harmonious patterns. Use the ideas presented below to help your students grasp the big ideas — to appreciate the fabric of science as a unified whole.

Study about the **causes of world hunger** and what you can do about it. For information, write:

FOOD FIRST
398 60th Street
Oakland CA 94618

Related TOPS modules that provide additional hands-on plant experiences using simple materials include:

38 GREEN THUMBS:
Radishes.

Beans and corn provide millions of people around our globe with **complete dietary protein**. Find out all you can about legumes and grains. Why do these from a complete protein when eaten together?

GREEN THUMBS: Corn and Beans 39

Two seeds come from the New World; two from the Old:

WHEAT CORN LENTILS PINTO BEANS



Which comes from where? Report on the **domestic origins** of each seed.

Wear an old sock over your shoe, then walk through a field. (Late summer or fall is the best time to do this. Winter is OK, but not spring.) Study the various kinds of **seeds that hitchhike** a ride on your sock: What do they look like? How many of each kind can you count? What kind of plants grow from these seeds?

Study the role of . . .
water,
wind,
insects,
in plant reproduction. How does
this relate to plant evolution?

Research what's in the **dry cereal** section of your grocery store. Make a table like this:

CEREAL NAME	GRAIN(S)	SUGAR
Fluff Puffs	rice, corn	1st ingredient

What is the unit price of the most and least expensive cereals; of main ingredients? What can you conclude?

TEACHING NOTES

These teaching notes begin your first day's lesson on **Corn and Beans**. If you haven't already done so, begin with *Getting Ready* (page A) and *Gathering Materials* (page B).

Lessons in this book are organized by days of the week. The bold slash and number heading each lesson indicate the number of days that precede or follow "FRI/0," when the corn and bean seeds are initially exposed to water. This beginning lesson is numbered MON/-4 because it is scheduled 4 days before Friday's watering event. Next Monday's lesson is numbered MON/3 because a weekend plus a day will have elapsed since Friday's watering event. Lessons continue each week-day until FRI/28, four full weeks after FRI/0.

To complete this module on schedule, find a 5 week period in your school calendar that is relatively vacation-free. Because FRI/0 is "zero hour," it must not be missed by any lab group. The 4 lessons that precede FRI/0 can be reasonably condensed into 3 days, since no plants are growing during this introductory period. After FRI/0, school days are generally easier to miss and make up in later weeks of the schedule rather than in the earlier weeks.

The calendar below indicates those days that your students will be directed by lab instructions. These lab instructions alone will be used during the first calendar week. Through the last 4 weeks, your students will use a combination of both lab instructions and journal pages. Those days marked "(journal)" indicate days when *only* journal pages are used, without lab instructions.

Headings begin with a single or double asterisk. On this page a single asterisk precedes "Make your Plant Journal." This implies that individuals (every student) should make a plant journal. Turn the page to TUE/-3, and you'll see that a double asterisk appears in front of "Build a Balance." This means that pairs of students may work together to produce a single balance with shared materials.

2. This step is labor-intensive. To expedite the process, furnish every student with scissors. Borrow extras if necessary. Soon your room will be awash in strips of paper. Distribute extra wastebaskets, or brown paper bags, to collect the confetti.

After they finish cutting, remind your students to count all their separated pieces. If they count fewer than 19 weekdays and 4 paper masses, they have neglected to separate all pieces. (Journal page 9 is often missed because it separates into 3 parts.) If overlooked cuts are not discovered now, students will complain of missing pages during final journal assembly in step 5.

4. Each student will need 2 pieces of clear tape per cut-out, or 38 total pieces. How do you cope with a classroom of students all needing so many pieces of tape at the same time? Easy: as students ask for tape, distribute strips as long as your arm (about 19 inches). Stick each long piece to the student's desk, with a paper clip under one end to make it easy to lift. Tell your students to snip short pieces from this longer strip, as wide as a fingernail (about 1/2 inch). They should temporarily stick these short pieces along the edges of their desks.

CORN AND BEANS ()

LAB INSTRUCTIONS

5 weeks
11 pages

CALENDAR

Begin this page on **MON/-4**, the first day of the first week. You'll finish these lab instructions 5 weeks later, on **TUE/25**.

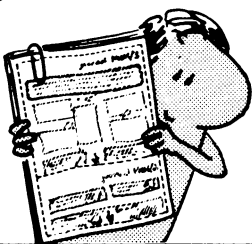
First Week:	MON/-4	TUE/-3	WED/-2	THU/-1	FRI/0
Second Week:	MON/3	(journal)	WED/5	THU/6	FRI/7
Third Week:	MON/10	(journal)	WED/12	(journal)	FRI/14
Fourth Week:	MON/17	TUE/18	(journal)	THU/20	FRI/21
Fifth Week:	(journal)	TUE/25	(journal)	(journal)	(journal)

Please don't write on these pages — keep them clean and new so others can use them after you.

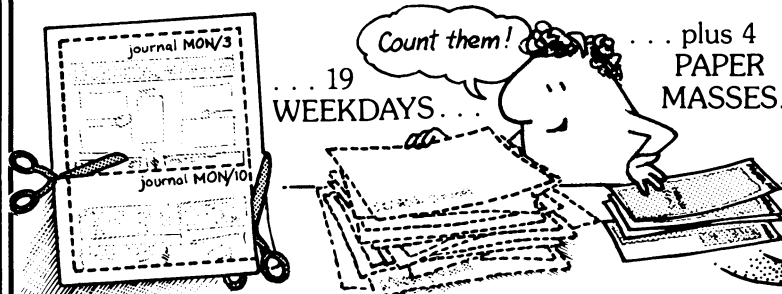
* Make your Plant Journal

lab MON/-4

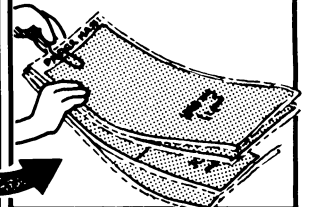
START: 1. Get 12 journal cutouts from your teacher.



2. Cut around the dashed lines into 23 separate parts:



3. Paper clip the four paper masses together, and set them aside.



TEACHING NOTES

These teaching notes (and all that follow) correspond visually to the pages in each student's plant journal. Model answers always appear in bold type.

Before your class begins today's activity, review the function of the numbered box at the top of each journal page. Point out that it acts as a road map when navigating between lab directions and written journal responses. Today, on MON/3 for example, you begin with four lab steps followed by a transition, in step 4, to three journal questions. Tomorrow, TUE/4, will be devoted exclusively to journal responses with no lab instructions at all.

2. These seeds will soften as they absorb water over the next 2 days, making them suitable for dissection on WED/5.

3. This step marks the beginning of a 4-week tradition. Every day your class will sketch their most advanced bean and corn plant. These are now in the form of sprouts, and they will rapidly grow into plants. Hold your students to their "bean-map" standard of excellence established on THU/-1. They'll reward you (and themselves) with their best effort. Soon they'll have an entire journal filled with excellent work, something to take home and proudly show family members.

Typical development, shown actual size:



5-6. Vertical arrows, at the bottom of this journal page, and on many pages that follow, show where long, straight lines should be drawn downward to function as space dividers. Students should do this now if they missed that instruction when they first assembled their journals.

Ask your students to bring their completed journal pages to your desk for your initialed approval. For details, turn one page to teaching notes TUE/4.

Additional Materials

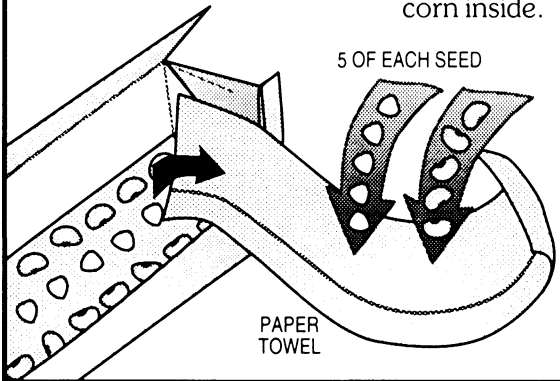
Your class has already constructed the lab equipment they'll need to complete most remaining activities. The word "additional" on our materials heading above indicates that from here forward, we will reference only new items, not already assembled on each lab group's storage mat. If no materials are listed, nothing new is required.

- Pinto beans and popcorn.

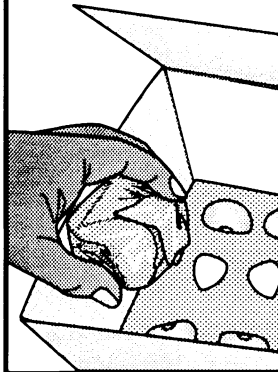
* Begin your Journal

lab MON/3

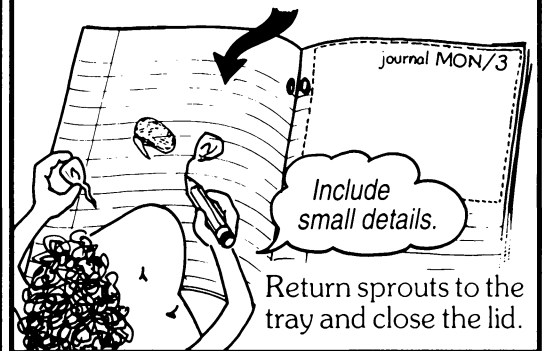
START: 1. Lift the top paper towel out of your seed tray. Wrap 5 dry beans and 5 dry corn inside.



2. Put these new seeds back inside.

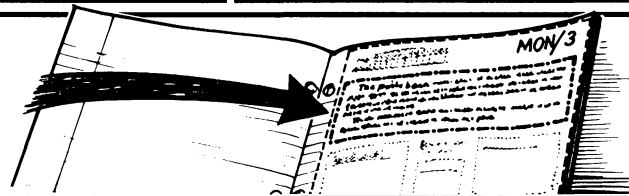


3. Find your most advanced bean and corn sprout. Draw both in your journal on the left page of MON/3.

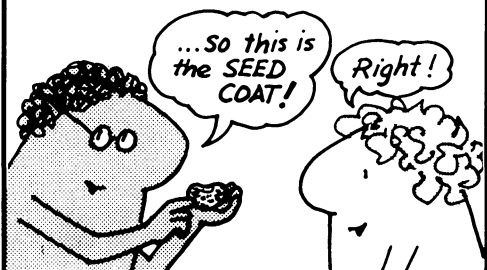


4. Read the big box on the right side of the page.

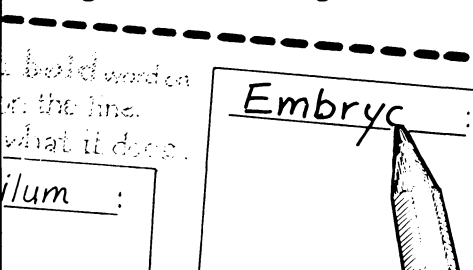
Get a dry bean and corn seed. Then do these steps:



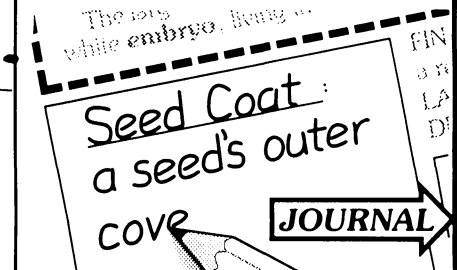
Find each part on the bean or corn...



Label each plant part on the diagram below the large box...



Define each part using your own words.



lab		2	3	4	5	6	7
journal	1						7

* Draw your Sprouts

START: 1. Draw your fastest-growing bean and corn sprout on the left page.

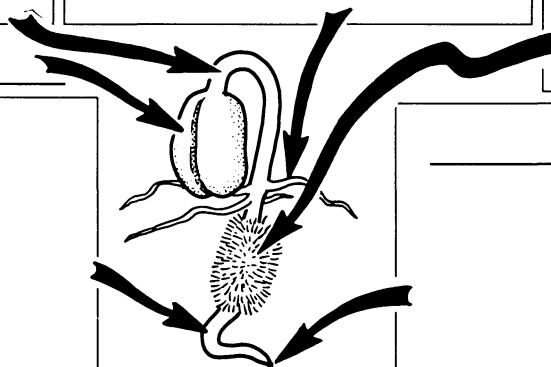


7. The lower half of the **BEAN** radicle develops into a complete root system: The **primary root** first grows down into the ground seeking moisture. The hard **root cap** at the tip protects it from being torn apart as it pushes through the soil. Tiny tubes called **root hairs**, visible along the sides, absorb extra water. These are soon replaced by branching **secondary roots** that absorb water and anchor the plant firmly in the soil. With the root system in place, the **hypocotyl** directly above it lengthens into a lower stem, pulling its **two cotyledons** up through the soil into open sunlight.

Corn also develops a **primary root**, **root cap** and **root hairs** similar to the bean. Then the **coleoptile** pushes up from its white **cotyledon** surrounded by the yellow **endosperm**. This coleoptile forms a hollow protective tube that encloses the leaves until they grow above ground. Meanwhile, **adventitious roots** grow from the base of the coleoptile to further support the plant and absorb water.

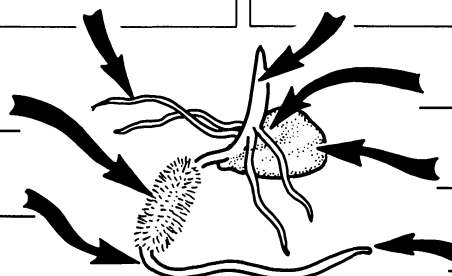
FIND it on a real sprout; LABEL it on the line; DEFINE what it does.

_____ :	_____ :	_____ :
---------	---------	---------



_____ :	_____ :
---------	---------

_____ :	_____ :
---------	---------



END