Swallowtail Sanctuary

The Builder's Laboratory Field Guide

Understanding Is Built, Not Delivered

Welcome, Builder

You are about to participate in one of nature's most remarkable engineering projects.

A Black Swallowtail butterfly begins life as a tiny egg on a fennel leaf. Over the next several weeks, it will eat, grow, shed its skin multiple times, construct a chrysalis, completely reorganize its body, and eventually emerge as a butterfly.

This field guide will help you do more than watch.

It will help you observe, question, document, and understand.

Whether you're a young explorer discovering caterpillars for the first time or an aspiring scientist collecting data, this guide will help you transform curiosity into capability.

Choose Your Path

Junior Builder (Ages 3–6)
Focus Areas:
- Observation
- Curiosity
- Empathy
- Stewardship

Activities:
- Caterpillar Calendar
- Daily Observation Prompts
- Habitat Care Checklist
- Reflection Activities

Turn to Page 2.

Advanced Architect (Ages 7+)
Focus Areas:
- Systems Thinking
- Data Collection
- Experimental Design
- Biological Engineering

Activities:
- Engineering Data Log
- Environmental Variable Tracking
- Lab vs. Wild Comparison Study
- Design Analysis Challenges

Turn to Page 5.

PAGE 2

Junior Builder Module

Mission: Care for a Living System

Your caterpillars depend on you.

Every day, observe carefully and ensure their habitat remains healthy and safe.

Remember:

A good builder takes care of what they build.

The Caterpillar Calendar

Draw what you see each day.

Day 1

What does your caterpillar look like?

Day 2

Did it eat today?

Day 3

Did anything change?

Day 4

What is your favorite thing about watching it?

Day 5

Can you spot something new?

Day 6

Draw a picture of your caterpillar.

Day 7

What surprised you this week?

PAGE 3

The Empathy Check

Every builder checks their system before starting work.

Can you help your caterpillars?

☐ They have fresh fennel, parsley, or dill.

☐ Their home is clean.

☐ They are safe from strong wind.

☐ They have room to move.

☐ They are not being touched too much.

☐ I used gentle observation today.

Observation Challenge

Can you find:

☐ A caterpillar eating

☐ A caterpillar resting

☐ Caterpillar waste (frass)

☐ A shed skin

☐ A chrysalis

☐ A butterfly

PAGE 4

Wonder Journal

Answer one question each day.

What do you think the caterpillar is working on today?

Why do you think it eats so much?

Why does it need a safe place?

What do you think happens inside the chrysalis?

How is a caterpillar different from a butterfly?

PAGE 5

Advanced Architect Module

Mission: Observe Like an Engineer

Engineers do not simply look at systems.

They identify variables.

They collect evidence.

They search for patterns.

As you observe your caterpillars, think about how different conditions influence outcomes.

Engineering Design Process

Observe

What is happening?

Question

Why is it happening?

Test

Can we identify variables?

Analyze

What patterns emerge?

Reflect

What did we learn?

PAGE 6

Builder's Data Log

Date Instar Stage Length (mm) Behavior Observed Notes

Behavioral Observation Ideas

Eating Rate

Movement Pattern

Color Changes

Molting Activity

Pupation Behavior

Environmental Conditions

PAGE 7

Nature's A/B Test

Lab Group vs. Wild Group

Compare your observations.

Environmental Variables

Variable	Lab Group	Wild Group
Temperature		
Wind Exposure		
Predator Risk		
Food Availability		
Human Observation		

Systems Analysis Questions

Which group appears to grow faster?

Which group faces more environmental challenges?

How might those challenges affect development?

What advantages exist in each environment?

PAGE 8

Construction Phase

Building a Successful Swallowtail Sanctuary

The chrysalis stage is one of the most sensitive periods in the lifecycle.
The environment you create matters.

Nutritional Inputs

Provide fresh:

- Fennel
- Dill
- Parsley

Avoid:

- Wilted foliage
- Treated plants
- Unknown pesticides

As caterpillars enter later instars, food consumption increases dramatically.
Always maintain a fresh supply.

Stability Engineering

Provide:

- Vertical branches
- Mesh surfaces
- Wooden dowels
- Natural twigs

The caterpillar must attach itself securely before forming a chrysalis.
Avoid moving the enclosure once wandering behavior begins.

Environmental Control

Remove frass daily.
Inspect for mold.
Maintain airflow.
Avoid excessive moisture.
Remember:
A healthy habitat produces reliable observations.

PAGE 9

Engineering Principles for Success

Principle 1: Inputs Matter

Every system depends on resources.

Healthy caterpillars require healthy plants.

Poor inputs produce poor outcomes.

Principle 2: Structure Supports Growth

The chrysalis cannot form without a stable attachment point.

Growth depends on infrastructure.

Principle 3: Variables Influence Outcomes

Temperature.

Predators.

Humidity.

Food quality.

Small changes can produce large effects.

Principle 4: Transformation Requires Time

The most important work often happens when we cannot see it.

Inside the chrysalis, an entirely new structure is being built.

Learning works the same way.

PAGE 10

Reflection & Agency

Congratulations.

You have completed the entire biological life cycle.

But the project is bigger than butterflies.

You have practiced:

- Observation
- Data collection
- Systems thinking
- Stewardship
- Patience
- Reflection

These are the same habits used by scientists, engineers, designers, and innovators.

Final Reflection

How has this experience changed the way you think about:

Plants?

Insects?

Nature?

Learning?

Continue Building

You've completed the Swallowtail Sanctuary Challenge.

Ready for the next project?

Explore more builder experiences:

- Bee Oasis
- The Future Builder's Starter Kit
- Mini Architecture, Major Learning
- Exploring Google's "Be Internet Awesome" Curriculum: Empowering Families to Navigate the Digital World
- Harnessing Machine Learning to Predict Air Quality: A Science Buddies Project
- How to Introduce STEM at Home: Fun Activities for Families
- #BuildYourWonder:
  - Mini Maker Starter Kits
  - From Couch to Creator: Hands-On Activities to Ignite Curiosity
  - Raising Real-World Ready Learners

Because curiosity is only the beginning.

The real transformation happens when children start building.

Stay connected:

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