# RLHF BOOK: CONSOLIDATED MASTER GUIDE

## PART 1: CHAPTER STRUCTURE & FLOW

*LOOP 1: INTERNAL FEEDBACK (Automatic, Inside Training)*

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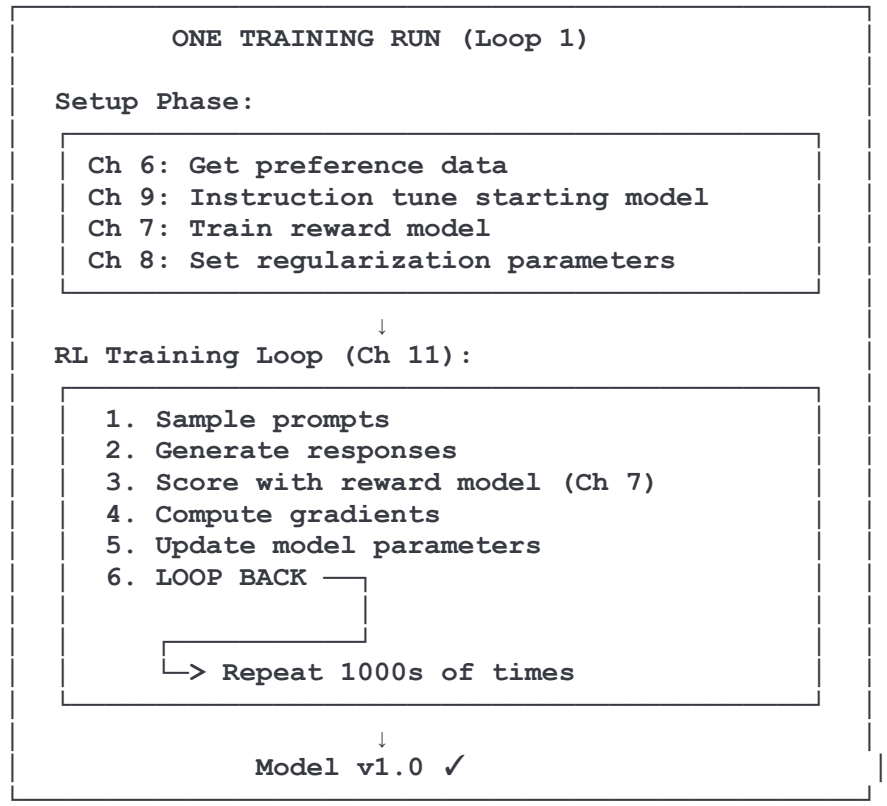
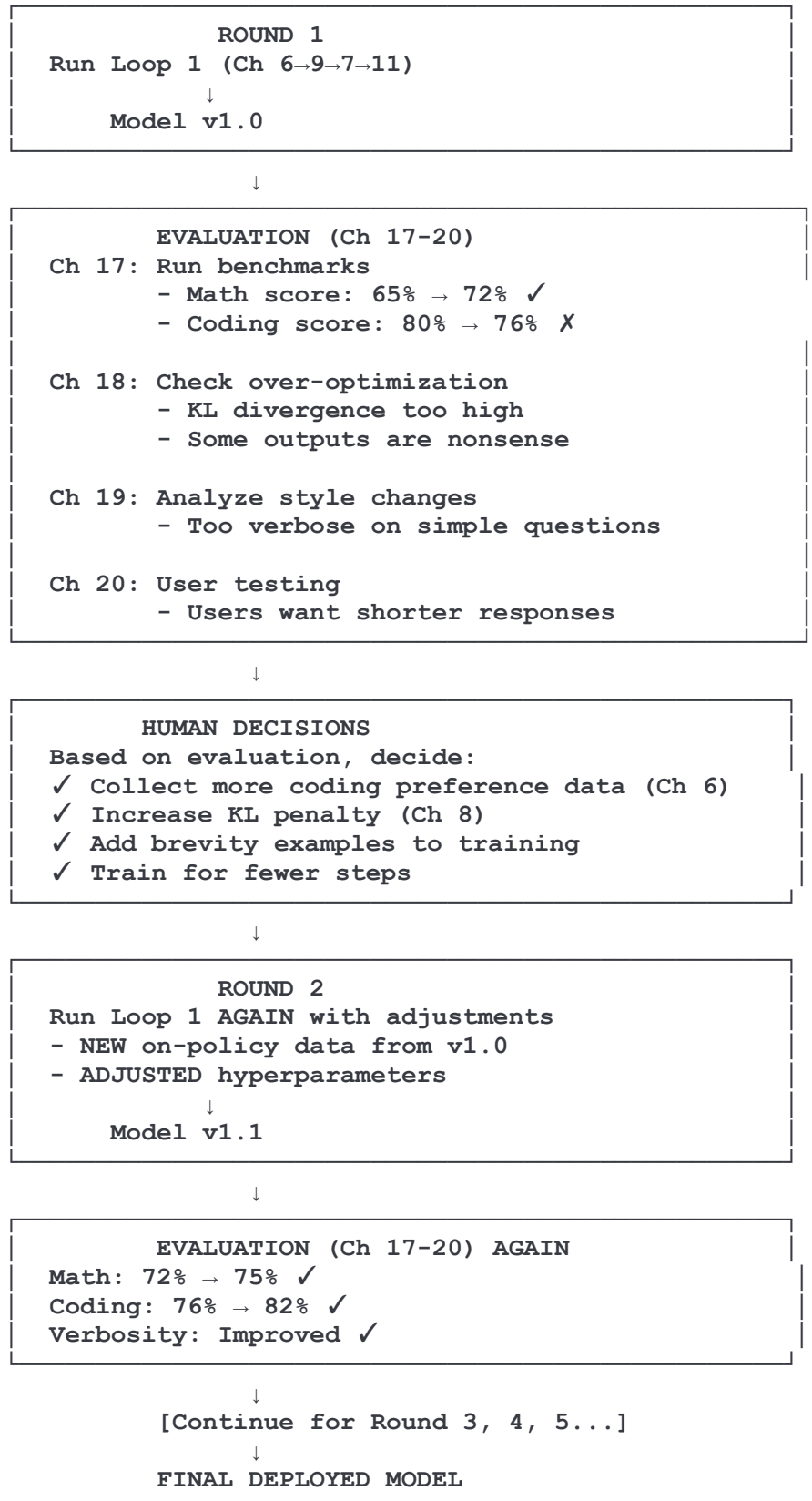
**Location: Inside Ch 11 (RL Optimization)**
**Duration: Hours to days**
**Automated: YES**
**Frequency: Thousands of iterations**




**This is what Ch 1-12 teaches you to do!**

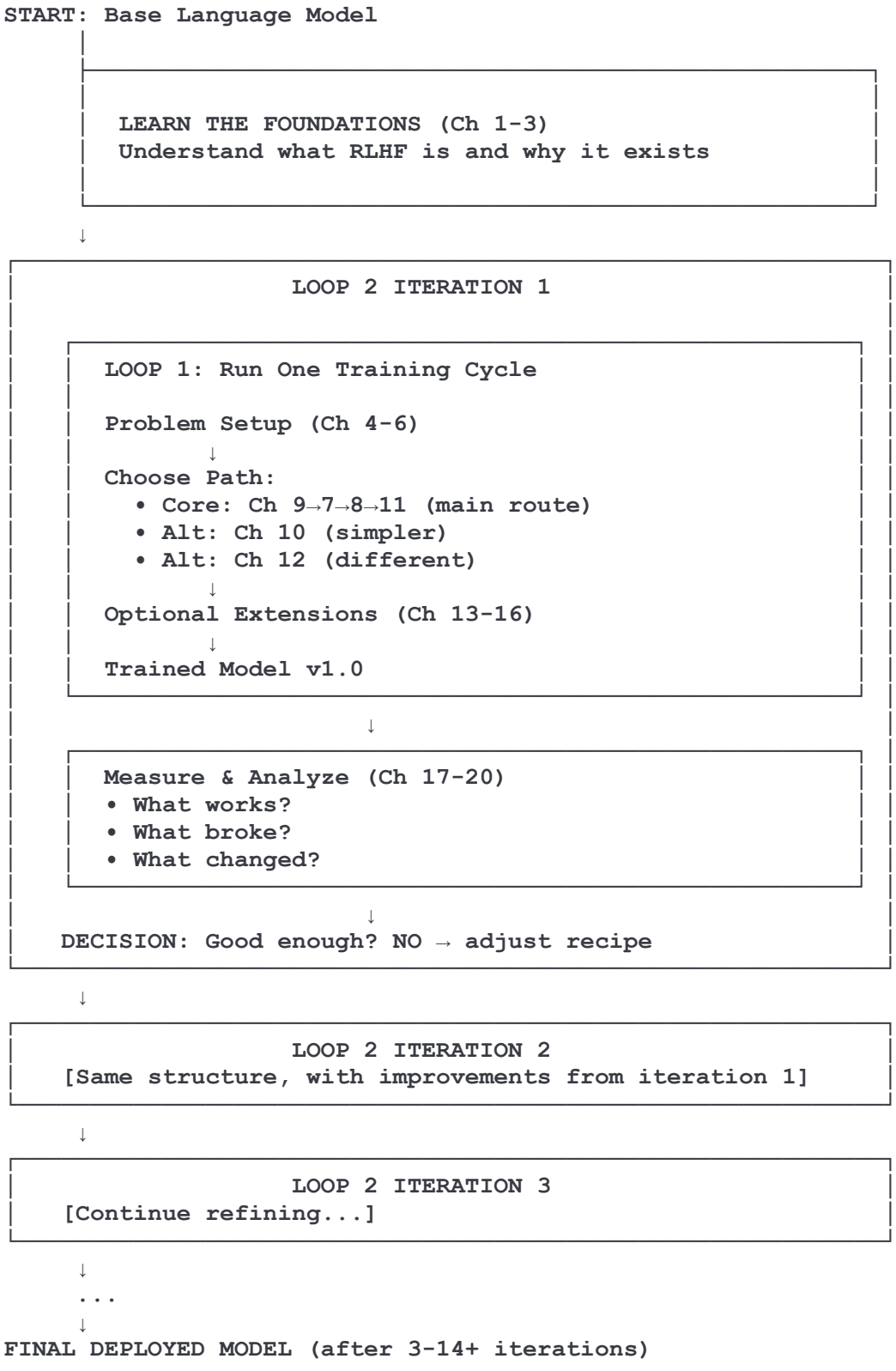
*LOOP 2: EXTERNAL FEEDBACK (Human-guided, Across Rounds)*

**Location: Across multiple training runs**
**Duration: Weeks to months**
**Automated: NO - requires human decisions**
**Frequency: 3-14+ major iterations for modern models**




**This is how Ch 17-20 feeds back to improve Ch 1-12!**

## PART 3: INTEGRATED VIEW - THE COMPLETE PICTURE



## PART 4: KEY CONNECTIONS SUMMARY

*BACKBONE CHAPTERS (The Core Path):*

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**Ch 6 (Data) → Ch 9 (SFT) → Ch 7 (Reward Model) → Ch 8 (Regularization) → Ch 11 (RL)**

*ALTERNATIVE ROUTES:*

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- **Ch 10 (Rejection Sampling) : Uses Ch 7 + Ch 9, skips Ch 11 (simpler)**
- **Ch 12 (DPO): Uses Ch 6 directly, skips Ch 7 (different approach)**

*EXTENSIONS:*

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- **Ch 16 (Synthetic Data) → replaces Ch 6**
- **Ch 13 (Constitutional AI) → uses Ch 16, feeds into Ch 7 or Ch 12**
- **Ch 14 (Reasoning) → uses Ch 11 algorithms with different rewards**
- **Ch 15 (Tool Use) → extends Ch 9 with special formatting**

*FEEDBACK MECHANISMS:*

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- **Ch 8 (Regularization) → prevents issues detected by Ch 18**
- **Ch 17 (Evaluation) → measures output of Ch 9/10/11/12**
- **Ch 18 (Over-optimization) → explains why Ch 8 exists**
- **Ch 19-20 → understand what the model actually learned**

LOOP STRUCTURE:

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- **Loop 1 (Internal): Inside Ch 11, automatic RL updates**
- **Loop 2 (External): Ch 17-20 evaluation → adjust Ch 1-12 → repeat**

## PART 5: PATHS FOR DIFFERENT GOALS

*PATH 1: Quick Understanding (Minimum viable knowledge)*

**"Understand the basic 3-stage pipeline and how to evaluate it"**

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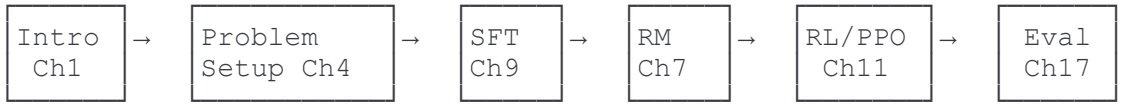


*PATH 2: Full Implementation (Learn to do it yourself)*

**"Master the core techniques and alternatives"**

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**Foundation:** Ch 1 (Intro) → Ch 2 (Key Works) → Ch 3 (Definitions)
**Problem:** Ch 4 (Problem Setup) → Ch 5 (Preferences) → Ch 6 (Data Collection)
**Core Pipeline:** Ch 9 (SFT) → Ch 7 (RM) → Ch 8 (Regularization/KL) → Ch 11 (RL/PPO)
**Alternatives:** Ch 10 (Rejection Sampling) → Ch 12 (DPO/Direct Alignment)
**Measurement:** Ch 17 (Evaluation) → Ch 18 (Over-optimization)

*PATH 3: Modern Production Systems (State of the art)*

**"Understand how frontier labs train their models"**

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**Complete Flow:**
Ch 1-12, 17-18 (Full Implementation)
**Extensions:**
Ch 16 (Synthetic Data) → Ch 13 (Constitutional AI/RLAIF)
Ch 14 (Reasoning/o1) [uses same RL as Ch 11]
Ch 15 (Tool Use) [extends Ch 9]
**Understanding Output:**
Ch 19 (Style & Info) → Ch 20 (Product/UX)

*PATH 4: Debugging & Troubleshooting (Fix what's broken)*

**"Focus on what goes wrong and how to fix it"**

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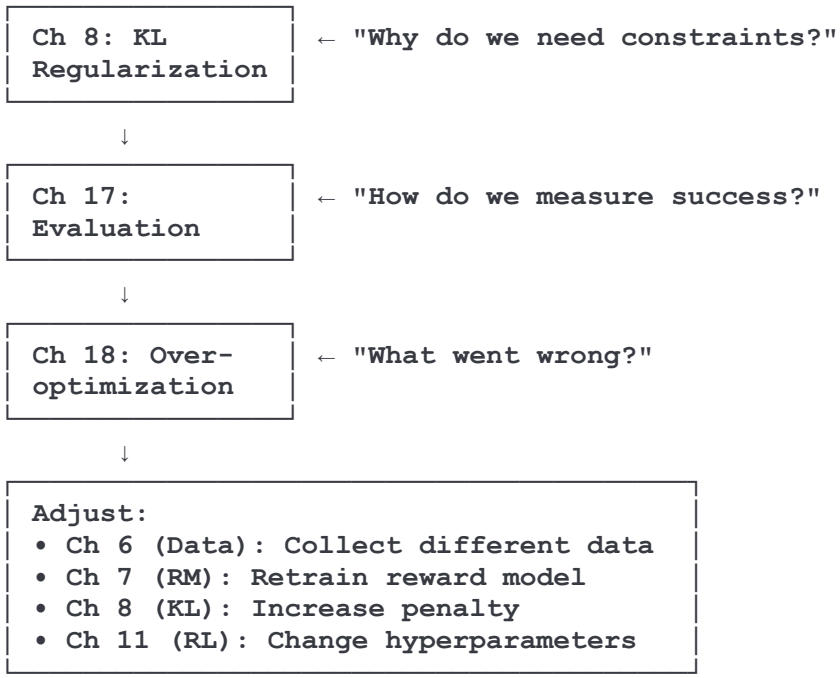

# QUICK REFERENCE: ALL CHAPTERS WITH TERMS

*FOUNDATIONS*

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**Ch 1: Introduction (Intro)**
**Ch 2: Key Related Works (Key Works)**
**Ch 3: Definitions & Background (Definitions)**

*PROBLEM SETUP*

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**Ch 4: Training Overview (Problem Setup)**
**Ch 5: The Nature of Preferences (Preferences)**
**Ch 6: Preference Data (Data Collection)**

*CORE OPTIMIZATION TOOLS*

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**Ch 7: Reward Modeling (Reward Model / RM)**
**Ch 8: Regularization (Regularization / KL Penalty)**
**Ch 9: Instruction Finetuning (Instruction Tuning / SFT)**
**Ch 10: Rejection Sampling (Rejection Sampling)**
**Ch 11: Reinforcement Learning (RL / PPO / Policy Gradients)**
**Ch 12: Direct Alignment Algorithms (DPO / Direct Alignment)**

*ADVANCED TECHNIQUES*

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**Ch 13: Constitutional AI & AI Feedback (Constitutional AI / RLAIF)**
**Ch 14: Reasoning Training (Reasoning / o1 / RLVR)**
**Ch 15: Tool Use & Function Calling (Tool Use)**
**Ch 16: Synthetic Data & Distillation (Synthetic Data)**

*MEASUREMENT & DEPLOYMENT*

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**Ch 17: Evaluation (Evaluation / Eval)**
**Ch 18: Over-optimization (Over-optimization)**
**Ch 19: Style & Information (Style & Info)**
**Ch 20: Product, UX, & Character (Product / UX)**

## ABBREVIATED NOTATION SYSTEM

**When discussing RLHF informally, you can use these shorthand terms:**

*CORE PIPELINE:*

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**SFT (Ch 9) → RM (Ch 7) → RL (Ch 11)**

*WITH PREREQUISITES:*

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**Data (Ch 6) → SFT (Ch 9) → RM (Ch 7) → KL (Ch 8) → RL (Ch 11)**

*ALTERNATIVES:*

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**- Rejection Sampling (Ch 10) = RM (Ch 7) + SFT (Ch 9) filtering**
**- DPO (Ch 12) = Skip RM (Ch 7), optimize directly from Data (Ch 6)**

*EXTENSIONS:*

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**- RLAIF (Ch 13) = AI-generated Data (Ch 6)**
**- o1-style (Ch 14) = RL (Ch 11) with binary rewards**
**- Tools (Ch 15) = Enhanced SFT (Ch 9)**
**- Synthetic (Ch 16) = Generated Data (Ch 6)**

*MEASUREMENT:*

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**Eval (Ch 17) → Over-opt Check (Ch 18) → Iterate**

## PART 6: THE ULTIMATE ONE-PAGE SUMMARY

*WHAT IS RLHF?*

**A technique to make language models follow human preferences using:**
**1. Instruction tuning (teach format)**
**2. Reward modeling (capture preferences)**
**3. RL optimization (optimize toward preferences)**

*HOW DOES IT WORK?*

**Two nested loops:**
- **Inner (Loop 1): RL algorithm updates model thousands of times**
- **Outer (Loop 2): Humans evaluate and adjust recipe 3-14+ times**

*WHAT DO THE CHAPTERS TEACH?*

- **Ch 1-6: Why RLHF exists and how to set it up**
- **Ch 7-12: How to execute one training run (Loop 1)**
- **Ch 13-16: Advanced variations and improvements**
- **Ch 17-20: How to measure success and iterate (Loop 2)**

*KEY INSIGHT:*

**Modern RLHF is NOT a single training run!**
**It's an iterative process: Train → Evaluate → Adjust → Repeat**

**The book teaches you:**
- **How to do ONE pass of Loop 1 (Ch 1-12)**
- **How to measure results for Loop 2 iterations (Ch 17-20)**
- **How advanced techniques fit into this framework (Ch 13-16)**