



## Vitax – Visualizing the NCBI Taxonomy

## Vitax – Visualisierung der NCBI Taxonomie

### Master's Thesis

verfasst am

**Max-Planck-Institut für Evolutionsbiologie**

im Rahmen des Studiengangs

**Molecular Life Science**

der Universität zu Lübeck

vorgelegt von

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ausgegeben und betreut von

**Prof. Dr. Bernhard Haubold**

mit Unterstützung von

**TO BE DETERMINED**

#### Eidesstattliche Erklärung

Ich erkläre hiermit an Eides statt, dass ich diese Arbeit selbständig verfasst und keine anderen als die angegebenen Quellen und Hilfsmittel benutzt habe.

*Tjorben Nawroth*

## Acknowledgements

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## **Abstract**

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## **Zusammenfassung**

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# 1 Preface

## 1.1 A Note on this Document's Format

This thesis partly contains a *literate program*, meaning that this document is generated from a source file containing both the narrative text and the complete, executable source code for the Vitax application. It is written using the *Typst* typesetting system with interspersed code chunks containing mainly HyperText Markup Language (HTML), Cascading Style Sheets (CSS) and TypeScript (TS).

- To produce this document, the source file had to be *weaved*, which means that the code chunks are printed into the document in a beautified form and automatically linked to each other and references in the text.
- To produce the executable application, the source file had to be *tangled*, which means that the code chunks are extracted and put together in a, for a computer, syntactically correct way.

## **2 Introduction**

### **2.1 The Importance of Taxonomy in Modern Biology**

### **2.2 The Challenge of Navigating Taxonomic Data**

### **2.3 Project Goals and Scope**

### **2.4 Thesis Structure**

## **3 Background and Fundamentals**

### **3.1 The NCBI Taxonomy Database**

### **3.2 Principles of Hierarchical Visualization**

### **3.3 Core Technologies**

#### **3.3.1 The *Never* Web Service and *Neighbors* Package**

#### **3.3.2 Frontend Web Technologies**

#### **3.3.3 Literate Programming and *Typst***

## **4 Implementation of Vitax**

### **4.1 Initial Prototyping**

#### **4.1.1 Go as WebAssembly**

#### **4.1.2 TypeScript with *D3.js***

### **4.2 The Final Architecture of Vitax**

### **4.3 Implementation**

#### **4.3.1 Taxon Search and Selection**

#### **4.3.2 Visualization**

#### **4.3.3 Interactivity and Data Access**



## **5 Results**

### **5.1 The Vitax Web application**

### **5.2 Evaluation of Frontend Approaches**

### **5.3 Writing a Thesis using *Litty***

## **6 Discussion**

### **6.1 Interpretation of Results**

### **6.2 Limitations of the Current Work**

### **6.3 Future Work and Potential Enhancements**

## **7 Conclusion**

## **8 Glossary**

### **8.1 Web**

**CSS – Cascading Style Sheets:** A style sheet language used for describing the presentation of a document written in HTML or XML. 1

**HTML – HyperText Markup Language:** The standard markup language for documents designed to be displayed in a web browser. 1

**TS – TypeScript:** A programming language developed and maintained by Microsoft that is a strict syntactical superset of JavaScript. 1

## **Bibliography**

## Appendix

If you need one, write your appendix here. Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aequaleam animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut postea variari voluptas distinguere possit, augeri amplificarique non possit. At etiam Athenis, ut e patre audiebam facete et urbane Stoicos irridente, statua est in quo a nobis philosophia defensa et collaudata est, cum id, quod maxime placeat, facere possimus, omnis voluptas assumenda est, omnis dolor repellendus. Temporibus autem quibusdam et.

### Appendix sections

In the appendix, use sections instead of chapters since the appendix is a chapter itself.