



Teal

An R-Shiny Framework to Unlock the Power
of Interactive Data Exploration

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@ R Consortium R Adoption Series Webinar

Agenda

1. Introduction to teal framework
2. Using teal as data scientist
3. Anatomy of teal and key features
4. Example app demo
5. Teal-verse product map

Product Development Data Sciences



**Main task:
reporting
clinical trials**

Summarising safety and efficacy data

Providing an accurate picture of trial outcomes

Managing data collection across international sites



Shifting to an open-source Data Science platform



**Talent out
of university
more likely
to know R**



**Open source
offered
opportunities:**

01

**Get latest developments
more rapidly**

02

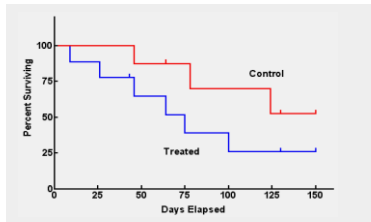
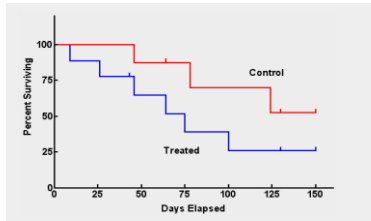
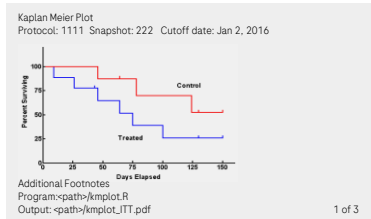
**Be able to switch between
languages and contexts
more easily**

03

**Collaboration with
external partners**

Improve efficiency in the way we work

Analyzing clinical trial data requires multiple ways of presenting and interacting with our data



Per-SAP static output
on **OS**

Ad-hoc analysis
on **PFS**

Ad-hoc analysis on **PFS**
in **subpopulation**

Example App with teal.modules.clinical.modules SPA

Study Information Data Table Variable Browser Demographic Table Forest Plots **Kaplan Meier Plt** Response Table Time to Event Table Cross Table Cox Reg

Logistic Reg MMRM Binary Response ANCOVA Report previewer

Reporter

Encodings

Datasets: ADSL, ADTE

Select Endpoint

Dataset: ADTE

Filter by

OS Overall Survival

Analysis Variable

Select ANAL

Censor Variable

Select OSGR

Facet Plots by

Dataset: ADSL

Select

Select Treatment Variable

Active Filter Summary

	OSs	Subjects
ADSL	400/400	400/400
ADTE	2000/2000	400/400

Active Filter Variables

ADSL

ADTE

Add Filter Variables

Add **ANAL** filter

Select variable to filter

Building scalable exploratory R-shiny web-apps

Building Scalable Exploratory Apps with {teal}



How to enable 600+ non-shiny developers to build exploratory apps for their clinical trials?



Build a **framework** centered around **reusable modules** that abstracts UI/server logic from the app developer

What is {teal}?



A Rshiny-based interactive data exploration framework



Modularized and standardized building blocks



Collection of specialized R packages



Streamlines creation of web-apps that offers:

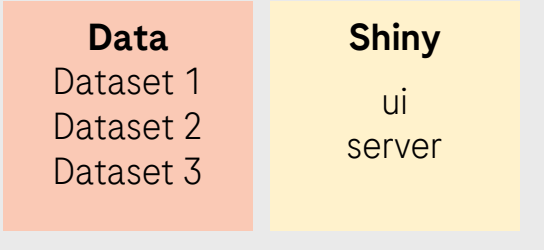
- Dynamic filtering facility
- Code reproducibility
- Reporting engine
- Many data summarization and visualizations



How does {teal} work?

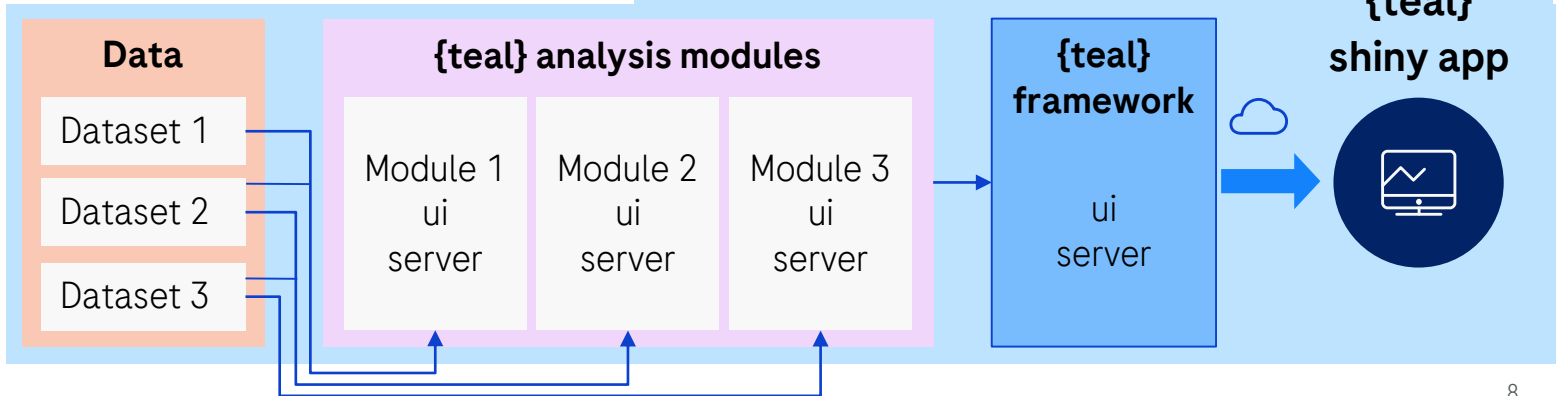


Traditional shiny app



{teal} framework with modularized components

- Data agnostic
- Flexible
- Cumulative
- Collaborative
- Crowdsourcing



Application of {teal}



Clinical trial reporting

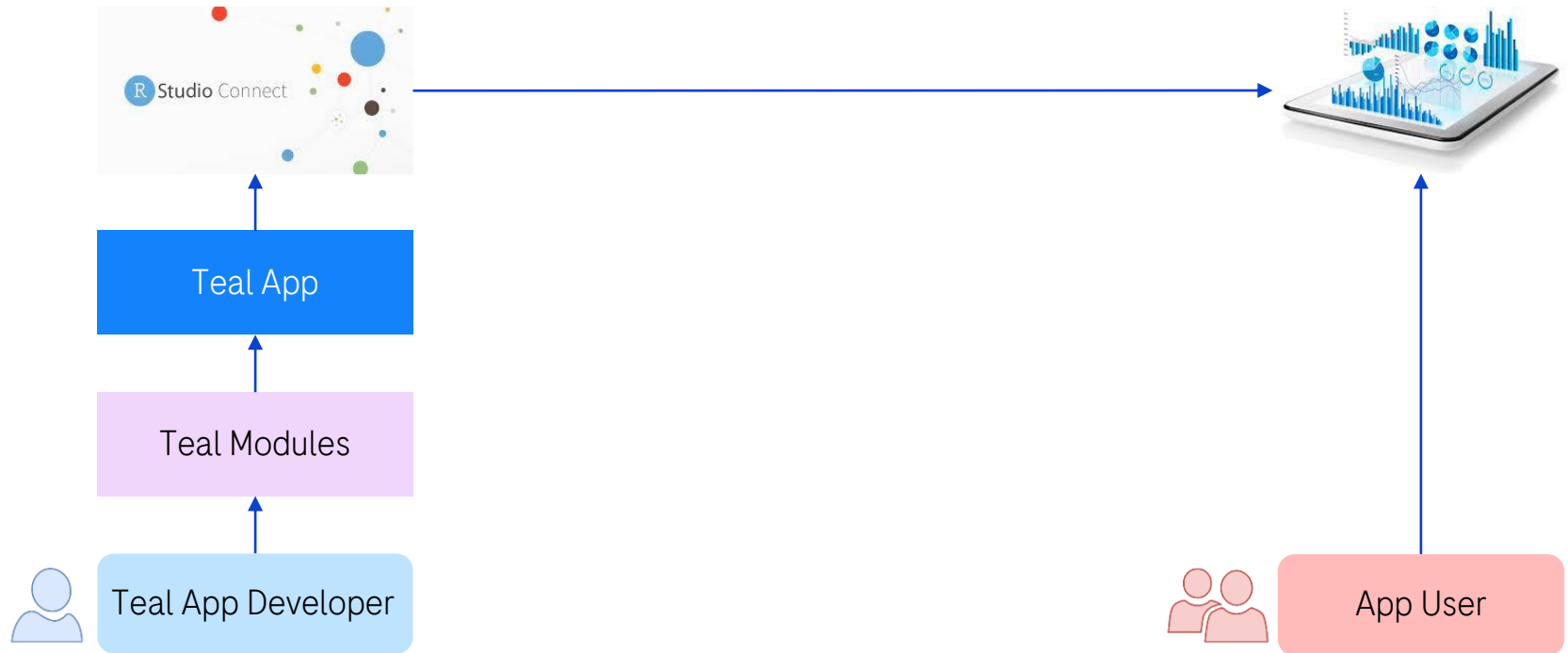
- QCing of clinical trial reporting outputs
- Trial monitoring
- Ad-hoc & exploratory analyses
- Content generation to support internal strategic decision meetings
- Complement study milestone events
- Pooled data analysis



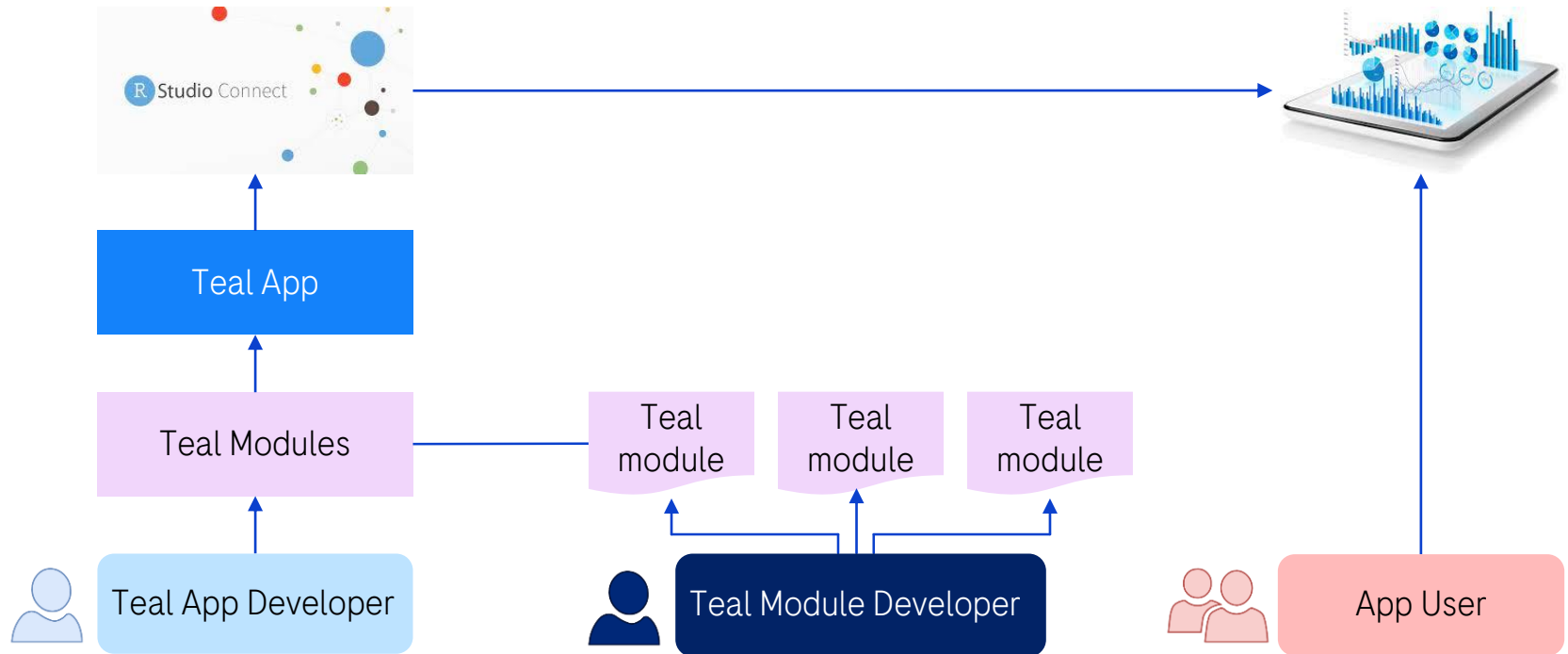
Outside of trial reporting setting

- Exploring high-dimensional biomarker
- Exploring real-world data off-label use
- Data quality monitoring
- Operations analytics

Using {teal} as a data scientist I



Using {teal} as a data scientist II



Installation

```
Sys.setenv(GITHUB_PAT = "your_access_token_here")  
if (!require("remotes")) install.packages("remotes")  
remotes::install_github("insightengineering/teal@*release")
```

Example App with teal.modules.general modules

Header

SPA

Study Information | File viewer | Data Table | Variable Browser | Missing Data | Distribution | Outliers | **Association** | Menu with tabs | Response Plot | Scatterplot matrix | Scatterplot | Table Choices | Principal Component Analysis | Report previewer

Reporter

Encodings

Dataset: ADSL

Reference variable

Select

AGE Age

Associated variables

Select

ARMCD ARMCD

Encodings

Association with the reference variable

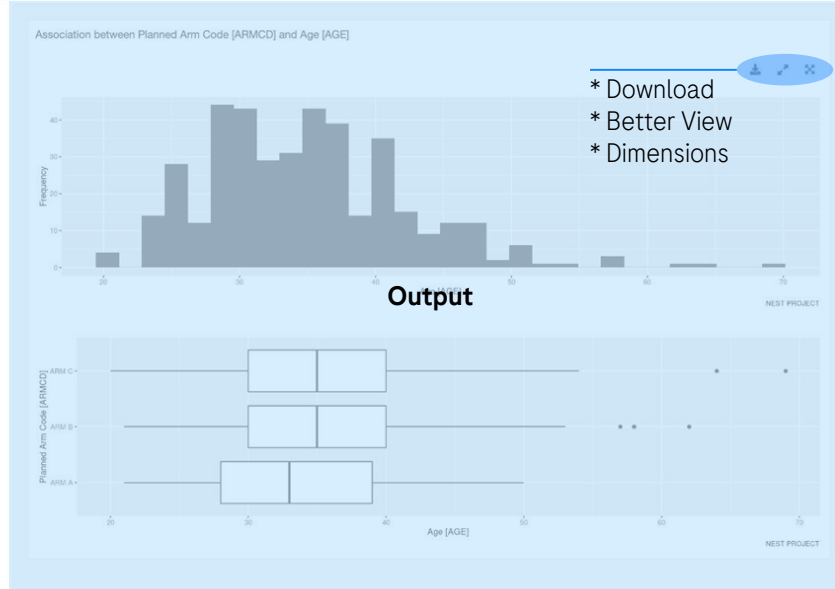
Distribution

Log transformed

Plot settings

Reproducibility

Debugging



* Toggle Filter Panel

Active Filter Summary

	Obs	Subjects
ADSL	400/400	400/400

Active Filter Variables

Filter Panel

ADSL

Add Filter Variables

Add ADSL filter

Select variable to filter



Anatomy of a teal app

LIVE DEMO

- Exploring teal features
- Creating a teal app



{teal} Playground

Posit Cloud Link:

- https://posit.cloud/spaces/340990/join?access_code=M52ibtFP2ASLLL1MItA-dThXpPzJvRqnxdNOgejA

Public Docker Image:

- https://github.com/insightengineering/ci-images/pkgs/container/rstudio-local_4.2.2_bioc_3.16



Example apps

library (teal.gallery)

- ▶ `launch_app("efficacy")`

- ▶ `launch_app("exploratory")`

- ▶ `launch_app("safety")`



Public websites

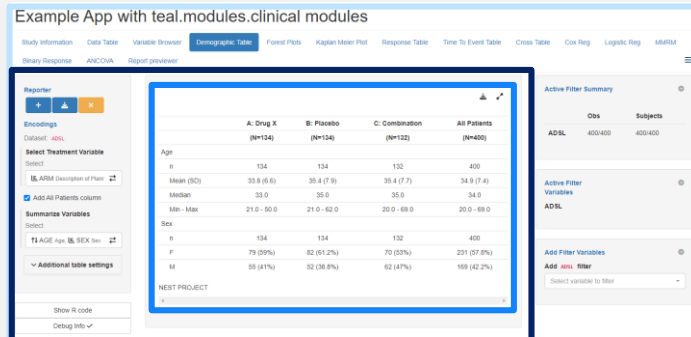
- ▶ [Efficacy analysis](#)

- ▶ [Exploratory analysis](#)

- ▶ [Safety analysis](#)



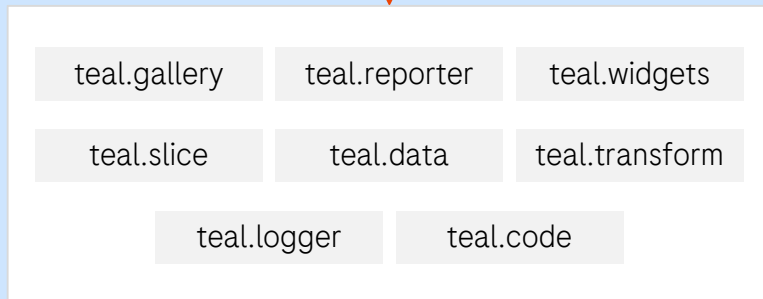
{teal} Universe Products Map



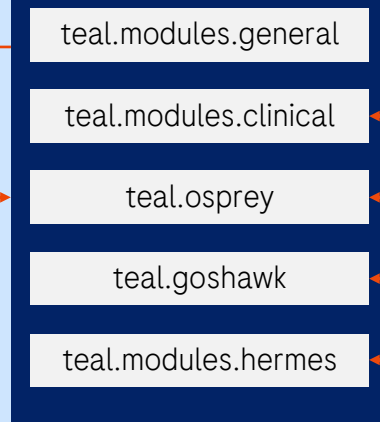
Teal framework



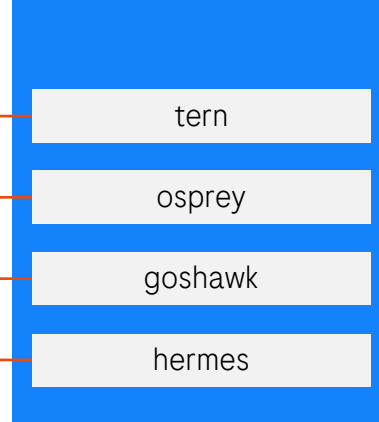
teal



Teal modules



Calculations





Teal Framework R Packages

- [teal](#): shiny-based interactive exploration framework for analyzing data.
- [teal.gallery](#): gallery of sample teal apps.
- [teal.widgets](#): shiny components used within teal.
- [teal.reporter](#): allows teal applications to generate reports.
- [teal.slice](#): provides a filtering panel to allow subset of data.
- [teal.data](#): creating and loading the data needed for teal applications.
- [teal.code](#): handles reproducibility of outputs.
- [teal.transform](#): standardizes extracting and merging data
- [teal.logger](#): standardizes logging within teal framework.



Teal Modules R Packages

- [teal.modules.general](#): general analysis modules for exploring any data types
- [teal.modules.clinical](#): modules for analyzing CDISC data and clinical trial reporting with [tern](#) R package
- [teal.osprey](#): modules for analyzing and reporting early-phase clinical trial data with [osprey](#) R package
- [teal.goshawk](#): modules for analyzing and visualizing biomarker data with [goshawk](#) R package
- [teal.modules.hermes](#): modules for analyzing and visualizing RNAseq data with [hermes](#) R package

Additional Resources



{teal} is part of pharmaverse:
<https://pharmaverse.org/>



More information about support:
<https://pharmaverse.org/support/>



Slack channel [#teal](#) under
pharmaverse workspace





Upcoming course on Coursera
“[Hands On Clinical Reporting Using R](#)”
in Q3 2023

Support

Packages

For all [pharmaverse packages](#) we recommend to use the following for support and communications between user and developer communities:

-  **Slack** - for informal discussions, Q&A and building user community
-  **GitHub Issues** - for direct feedback, enhancement requests or raising bugs

Collaborating on {teal}



We are looking for collaborators to develop this framework further!



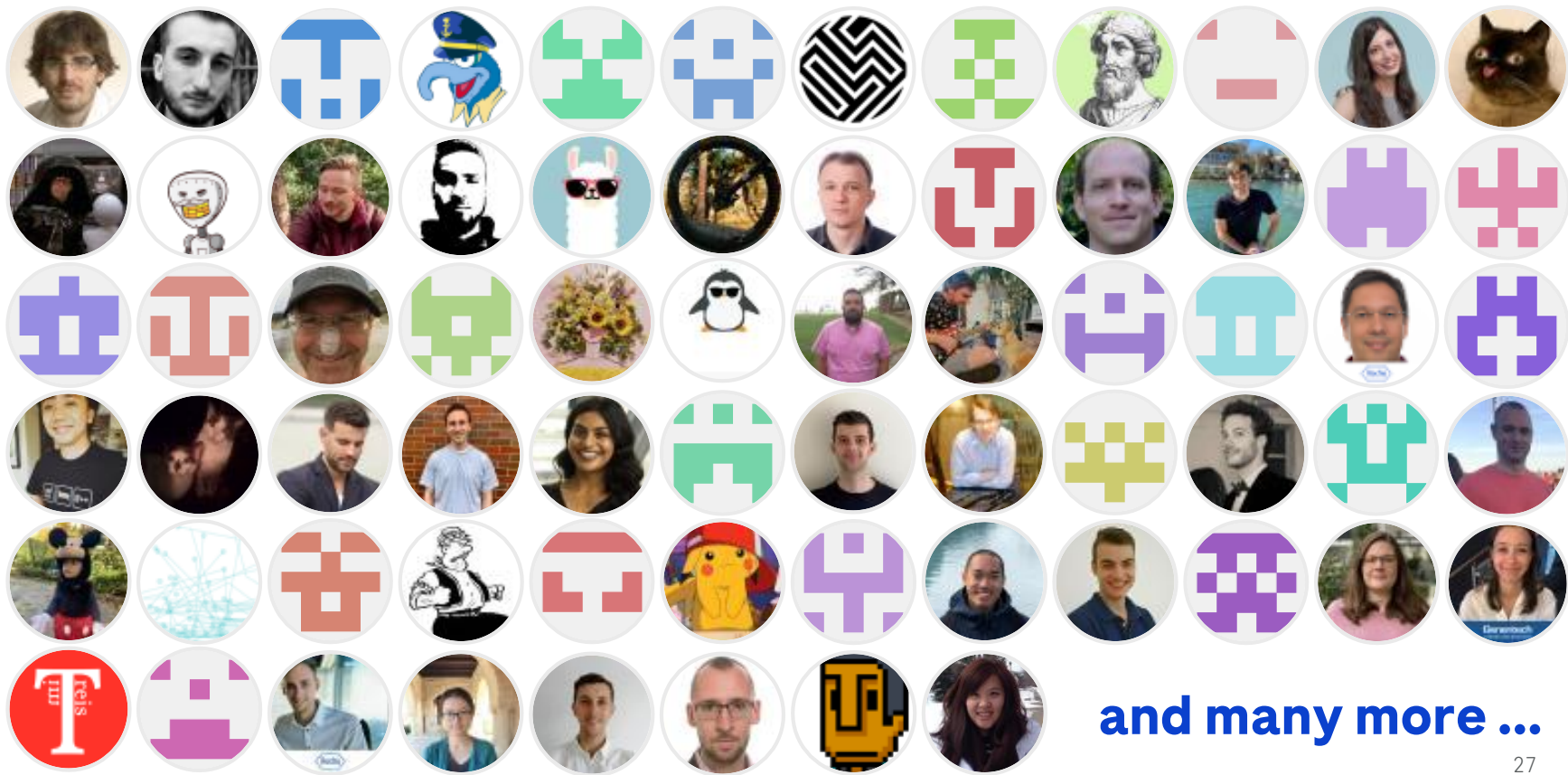
If you're an individual please contribute on GitHub and join us the [#teal](#) channel of [pharmaverse](#) Slack



If you're an organization wanting to adopt {teal} and co-develop it please get in touch with thomas.neitmann@roche.com



Acknowledgement



and many more ...

Doing now what patients need next