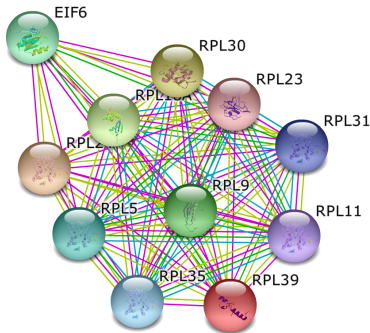# RAIN: RNA–protein Association and Interaction Networks

Junge, Refsgaard, Garde, Pan, Santos, Alkan, Anthon, von Mering, Workman, Jensen, Gorodkin.

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The STRING database (http://string-db.org/)

- protein-protein interaction networks for 2031 organisms
- integrates known and predicted protein-protein associations, e.g.,
  - experiments
  - text-mining
  - genomic context
- interactions are scored according to their reliability

[Szklarczyk et al., Nucl. Acids Res., 2015]

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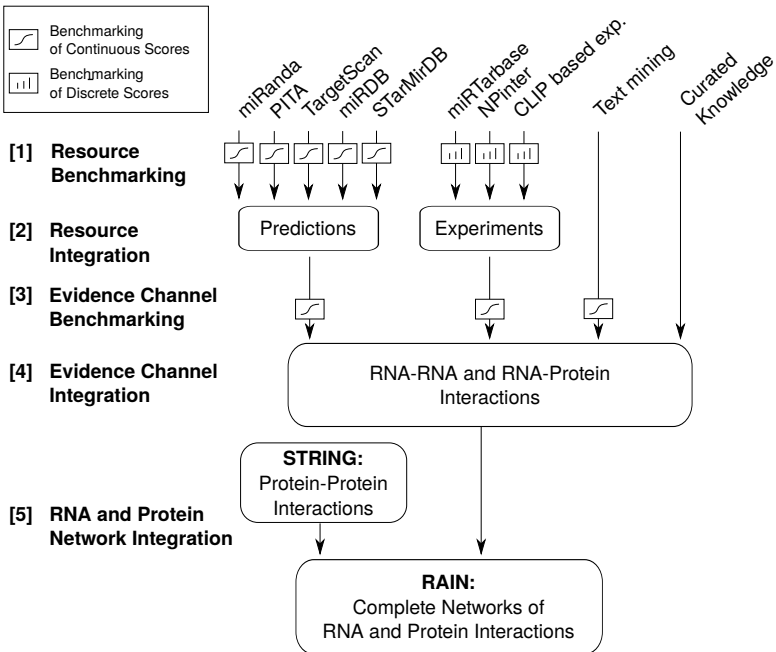- **no such resource for ncRNA interactions**
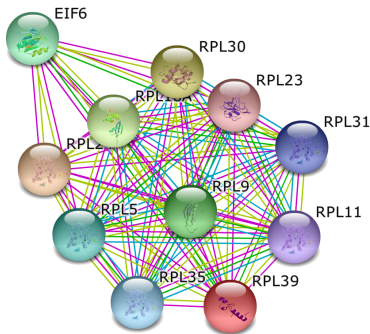
[Szklarczyk et al., Nucl. Acids Res., 2015]

RAIN - main features

1. **collects** ncRNA-RNA and ncRNA-protein interactions from various sources
2. **unifies** ncRNA and protein interactions

RAIN pipeline

From raw interaction scores to confidences

miRNA	Target	Raw score
miR-4685-5p	KRAS	16.8
miR-548at-3p	RUNX1	13.2
miR-205-3p	ELF2	2.0
$\vdots$	$\vdots$	$\vdots$

$\rightarrow$ translate (predicted) raw scores into confidence scores $\in [0, 1]$
by fitting a calibration curve

From raw interaction scores to confidences

Gold standard: expert curated miRNA-mRNA interactions

sliding window

raw interaction score

● TP   ○ FP   ◉ Unknown
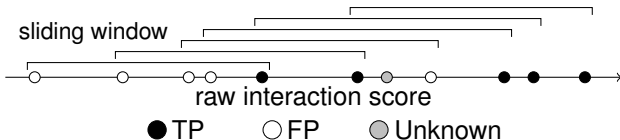
From raw interaction scores to confidences

Gold standard: expert curated miRNA-mRNA interactions
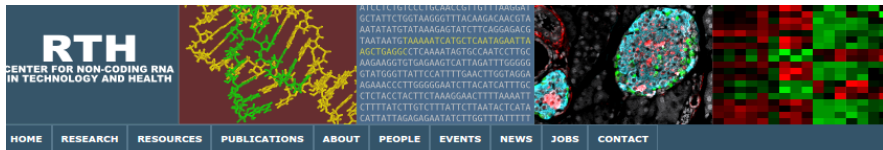
RAIN interaction counts

Interactions with confidence score > 0.15

	miRNA–mRNA	ncRNA–protein	ncRNA–ncRNA	Total
H. sapiens (Human)	174,853	11,026	2,507	188,386
M. musculus (Mouse)	77,270	469	35	77,774
R. norvegicus (Rat)	19,985	39	1	20,025
S. cerevisiae (Yeast)	0	640	85	725
Total	272,108	12,174	2,628	286,910

RAIN webinterface
http://rth.dk/resources/rain

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RAIN: RNA–protein Association and Interaction Networks

Search for interactions by non-coding RNA (ncRNA) or gene identifier in an organism of interest.

ncRNA or gene identifier: (examples: #1 #2)

[mir 145]   Help [?]

organism(*):

[Homo sapiens ▼]

[Search]   [Reset]

The following ncRNAs and/or genes match your input. Please review the list, click the desired name directly.
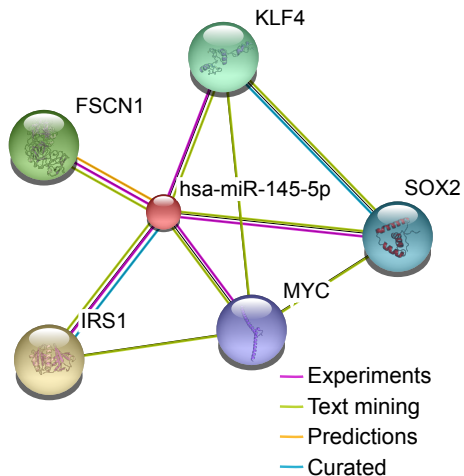
ncRNAs:

ncRNA "mir-145":
hsa-miR-145-3p
hsa-miR-145-5p

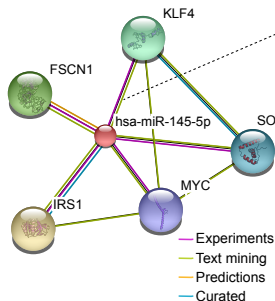[<- Back]

Search
- Single name
- Multiple names

Help

Download

RAIN webinterface

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Conclusion - RAIN

- **integrate** different sources of ncRNA-target interactions
- **convert** raw interaction scores to confidences
- **provide** research community with more complete picture
    - protein-protein interactions
    - ncRNA-protein interactions
    - ncRNA-RNA interactions

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- Giulia Corsi

More tools: http://rth.dk/resources

External collaborators:

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- Jan C Refsgaard, University of Copenhagen
- Alberto Santos, , University of Copenhagen
- Christopher Workman, Technical University of Denmark
- Christian Garde, Technical University of Denmark
- Christian von Mering, Univesity of Zurich

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