

## Supplementary Information

### PCNA in Pan-Cancer: A Prognostic Biomarker Unveiled Through a Data-Driven, Multidimensional Analysis of Transcriptomics, Immunity, and Functional Profiling

Depanshi Pandit<sup>1</sup>, Ravindranath Bilachi Sanganabasappa<sup>2\*</sup> Amardeep Dhillon<sup>3</sup>, Sanjiban Chakrabarty<sup>4</sup>

1. Department of Biotechnology, Manipal Institute of Technology, Manipal, Manipal Academy of Higher Education, Manipal, Karnataka, India-576104. Email: [depanshi.mitmpl2023@learner.manipal.edu](mailto:depanshi.mitmpl2023@learner.manipal.edu)
2. Department of Biotechnology, Manipal Institute of Technology, Manipal, Manipal Academy of Higher Education, Manipal, Karnataka, India-576104. Email: [ravindranath.bs@manipal.edu](mailto:ravindranath.bs@manipal.edu)
3. The Institute for Mental and Physical Health and Clinical Translation, School of Medicine, Deakin University, Geelong, Waurn Ponds, Victoria 3216, Australia. Email: [amardeep.dhillon@deakin.edu.au](mailto:amardeep.dhillon@deakin.edu.au)
4. Department of Public Health Genomics, Manipal School of Life Sciences, Manipal Academy of Higher Education, Manipal, India-576104. Email: [sanjiban.c@manipal.edu](mailto:sanjiban.c@manipal.edu)

**\*Corresponding Author:** Ravindranath Bilachi Sanganabasappa.  
[ravindranath.bs@manipal.edu](mailto:ravindranath.bs@manipal.edu)

**Supplementary data for the mRNA  
expression analysis of PCNA in different  
cell line categories.**

<b>Cell line group</b>	<b>No. of Cell lines</b>	<b>Avg. Expression (nTPM)</b>
Lymphoma	76	638.9
Leukemia	93	540.7
Bile duct cancer	7	531.8
Bladder cancer	26	456
Colorectal cancer	63	423.9
Skin cancer	62	384.4
Cervical cancer	8	378.4
Bone cancer	21	376.6
Gastric cancer	42	372
Neuroblastoma	17	364.9
Liver cancer	24	362.5
Breast cancer	62	359.4
Myeloma	34	354
Brain cancer	80	340.7
Kidney cancer	35	340.5
Lung cancer	232	336.3
Esophageal cancer	27	335.3
Prostate cancer	8	331.1
Sarcoma	15	328
Pancreatic cancer	46	326.7
Ovarian cancer	59	321.7
Thyroid cancer	11	313
Rhabdoid	14	311.8
Head and neck cancer	38	303.7
Uncategorised	11	299.1
Uterine cancer	29	282.3
Non- cancerous	63	223.6
Adrenocotical cancer	1	213.6
Testis cancer	1	197
Gallbladder cancer	1	188.4

**Table S1:** Average mRNA levels of PCNA in different cell lines (Source: HPA database)

**Supplementary data for the analysis of  
mapping pan-cancer expression of PCNA in  
cancer pathways.**

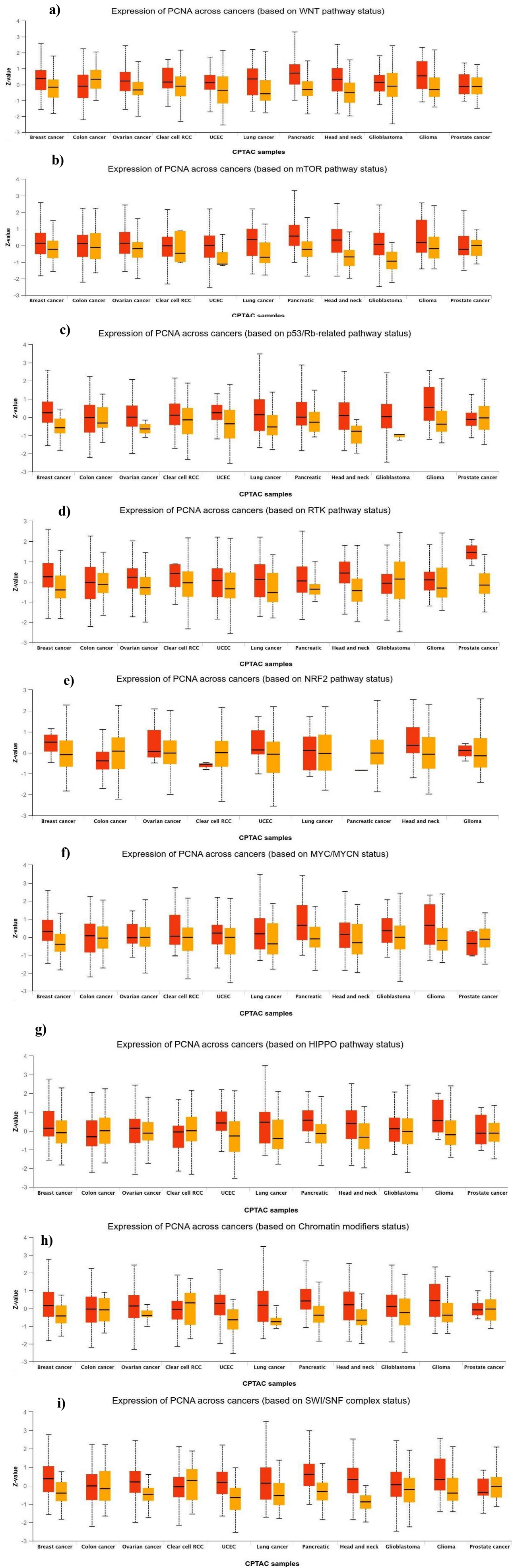


Figure S1 a-i Box plots of PCNA expression level across pan-cancer in altered (red) vs non altered (yellow) in different signalling pathways (Source: UALCAN).

Gene	Pathway	Cancer	Parameters	Altered	Unaltered/Others	Statistical significance
PCNA	WNT	Breast cancer	MEDIAN	0.376	-0.171	3.41E-03Significant
PCNA	WNT	Ovarian	MEDIAN	0.233	-0.341	1.99E-02Significant
PCNA	WNT	UCEC	MEDIAN	0.119	-0.361	1.64E-02Significant
PCNA	WNT	Lung cancer	MEDIAN	0.35	-0.562	9.97E-04Significant
PCNA	mTOR	Breast cancer	MEDIAN	0.137	-0.217	2.69E-02Significant
PCNA	mTOR	Ovarian	MEDIAN	0.141	-0.179	1.75E-02Significant
PCNA	mTOR	Lung cancer	MEDIAN	0.35	-0.695	9.61E-05Significant
PCNA	mTOR	Pancreatic cancer	MEDIAN	0.581	-0.225	1.58E-05Significant
PCNA	mTOR	Head and neck cancer	MEDIAN	0.334	-0.687	3.11E-07Significant
PCNA	mTOR	Glioblastoma	MEDIAN	0.085	-0.934	4.56E-04Significant
PCNA	p53/Rb	Breast cancer	MEDIAN	0.252	-0.569	3.13E-08Significant
PCNA	p53/Rb	Clear Cell RCC	MEDIAN	0.127	-0.13	2.73E-02Significant
PCNA	p53/Rb	UCEC	MEDIAN	0.252	-0.348	3.13E-03Significant
PCNA	p53/Rb	Lung cancer	MEDIAN	0.14	-0.536	3.06E-02Significant
PCNA	RTK	Breast cancer	MEDIAN	0.242	-0.403	2.34E-04Significant
PCNA	RTK	Head and neck cancer	MEDIAN	0.436	-0.439	3.26E-03Significant
PCNA	NRF2	Pancreatic cancer	MEDIAN	-0.831	-0.003	1E-12 Significant
PCNA	Chromatin modifier	Breast cancer	MEDIAN	0.173	-0.418	7.07E-05Significant
PCNA	Chromatin modifier	UCEC	MEDIAN	0.298	-0.634	8.82E-06Significant
PCNA	Chromatin modifier	Lung cancer	MEDIAN	0.178	-0.74	1.39E-05Significant
PCNA	Chromatin modifier	Pancreatic cancer	MEDIAN	0.425	-0.382	1.52E-08Significant
PCNA	Chromatin modifier	Head and neck cancer	MEDIAN	0.198	-0.655	6.34E-04Significant
PCNA	Chromatin modifier	Glioblastoma	MEDIAN	0.121	-0.229	3.83E-02Significant
PCNA	MYC/MYCN	Breast cancer	MEDIAN	0.308	-0.403	4.00E-04Significant
PCNA	MYC/MYCN	Lung cancer	MEDIAN	0.193	-0.377	3.33E-02Significant
PCNA	MYC/MYCN	Pancreatic cancer	MEDIAN	0.659	-0.101	6.59E-03Significant
PCNA	SWI/SNF	Breast cancer	MEDIAN	0.372	-0.394	1.08E-06Significant
PCNA	SWI/SNF	Ovarian	MEDIAN	0.206	-0.474	4.80E-02Significant
PCNA	SWI/SNF	UCEC	MEDIAN	0.188	-0.632	1.01E-05Significant
PCNA	SWI/SNF	Lung cancer	MEDIAN	0.14	-0.536	2.12E-02Significant
PCNA	SWI/SNF	Pancreatic cancer	MEDIAN	0.612	-0.318	8.67E-10Significant
PCNA	SWI/SNF	Head and neck cancer	MEDIAN	0.344	-0.869	3.40E-09Significant
PCNA	HIPPO	UCEC	MEDIAN	0.422	-0.27	8.91E-04Significant
PCNA	HIPPO	Lung cancer	MEDIAN	0.464	-0.395	1.18E-02Significant
PCNA	HIPPO	Pancreatic cancer	MEDIAN	0.581	-0.136	1.76E-03Significant
PCNA	HIPPO	Head and neck cancer	MEDIAN	0.395	-0.327	1.08E-03Significant
PCNA	WNT	Colon cancer	MEDIAN	-0.1	0.331	1.76E-01Insignificant
PCNA	WNT	Clear Cell RCC	MEDIAN	0.173	-0.095	1.67E-01Insignificant
PCNA	WNT	Pancreatic cancer	MEDIAN	0.724	-0.303	NA Insignificant
PCNA	WNT	Head and neck cancer	MEDIAN	0.344	-0.512	NA Insignificant
PCNA	WNT	Glioblastoma	MEDIAN	0.141	-0.093	NA Insignificant
PCNA	WNT	Glioma	MEDIAN	0.557	-0.316	NA Insignificant
PCNA	WNT	Prostate cancer	MEDIAN	-0.114	-0.128	8.17E-01Insignificant
PCNA	mTOR	Colon cancer	MEDIAN	0.12	-0.117	8.52E-01Insignificant
PCNA	mTOR	Clear Cell RCC	MEDIAN	0	-0.468	8.08E-01Insignificant
PCNA	mTOR	UCEC	MEDIAN	0.008	-1.118	1.89E-01Insignificant
PCNA	mTOR	Glioma	MEDIAN	0.191	-0.191	NA Insignificant
PCNA	mTOR	Prostate cancer	MEDIAN	-0.232	0.021	3.38E-01Insignificant
PCNA	p53/Rb	Colon cancer	MEDIAN	-0.004	-0.309	6.81E-01Insignificant
PCNA	p53/Rb	Ovarian	MEDIAN	0.002	-0.631	3.79E-01Insignificant
PCNA	p53/Rb	Pancreatic cancer	MEDIAN	0.018	-0.262	NA Insignificant
PCNA	p53/Rb	Head and neck cancer	MEDIAN	0.099	-0.778	NA Insignificant
PCNA	p53/Rb	Glioblastoma	MEDIAN	0.04	-0.935	NA Insignificant
PCNA	p53/Rb	Glioma	MEDIAN	0.559	-0.387	NA Insignificant
PCNA	p53/Rb	Prostate cancer	MEDIAN	-0.114	-0.026	9.25E-01Insignificant
PCNA	RTK	Colon cancer	MEDIAN	-0.031	-0.128	9.79E-01Insignificant
PCNA	RTK	Ovarian	MEDIAN	0.233	-0.295	1.70E-01Insignificant
PCNA	RTK	Clear Cell RCC	MEDIAN	0.419	-0.05	3.94E-01Insignificant
PCNA	RTK	UCEC	MEDIAN	0.073	-0.345	1.64E-01Insignificant
PCNA	RTK	Lung cancer	MEDIAN	0.113	-0.524	8.40E-02Insignificant
PCNA	RTK	Pancreatic cancer	MEDIAN	0.041	-0.356	1.44E-01Insignificant
PCNA	RTK	Glioblastoma	MEDIAN	-0.065	0.141	6.60E-01Insignificant
PCNA	RTK	Glioma	MEDIAN	0.101	-0.298	NA Insignificant
PCNA	RTK	Prostate cancer	MEDIAN	1.45	-0.161	2.31E-01Insignificant
PCNA	NRF2	Breast cancer	MEDIAN	0.508	-0.081	3.62E-01Insignificant
PCNA	NRF2	Colon cancer	MEDIAN	-0.379	0.079	1.08E-01Insignificant
PCNA	NRF2	Ovarian	MEDIAN	0.065	-0.007	5.63E-01Insignificant
PCNA	NRF2	Clear Cell RCC	MEDIAN	-0.557	0.007	6.01E-01Insignificant
PCNA	NRF2	UCEC	MEDIAN	0.138	-0.066	7.56E-02Insignificant
PCNA	NRF2	Lung cancer	MEDIAN	0.127	-0.028	8.66E-01Insignificant
PCNA	NRF2	Head and neck cancer	MEDIAN	0.367	-0.068	5.23E-02Insignificant
PCNA	NRF2	Glioma	MEDIAN	0.114	-0.146	NA Insignificant
PCNA	Chromatin modifier	Colon cancer	MEDIAN	-0.031	-0.076	7.10E-01Insignificant
PCNA	Chromatin modifier	Ovarian	MEDIAN	0.141	-0.39	9.70E-02Insignificant
PCNA	Chromatin modifier	Clear Cell RCC	MEDIAN	-0.061	0.309	7.17E-01Insignificant
PCNA	Chromatin modifier	Glioma	MEDIAN	0.447	-0.388	NA Insignificant
PCNA	Chromatin modifier	Prostate cancer	MEDIAN	-0.081	-0.026	1.00E+00Insignificant
PCNA	MYC/MYCN	Colon cancer	MEDIAN	0.08	-0.054	8.67E-01Insignificant
PCNA	MYC/MYCN	Ovarian	MEDIAN	-0.037	-0.002	8.46E-01Insignificant
PCNA	MYC/MYCN	Clear Cell RCC	MEDIAN	0.061	-0.001	1.38E-01Insignificant
PCNA	MYC/MYCN	UCEC	MEDIAN	0.229	-0.017	1.91E-01Insignificant
PCNA	MYC/MYCN	Head and neck cancer	MEDIAN	0.157	-0.318	7.42E-02Insignificant
PCNA	MYC/MYCN	Glioblastoma	MEDIAN	0.351	-0.005	3.04E-01Insignificant
PCNA	MYC/MYCN	Glioma	MEDIAN	0.657	-0.182	NA Insignificant
PCNA	MYC/MYCN	Prostate cancer	MEDIAN	-0.349	-0.114	5.73E-01Insignificant
PCNA	SWI/SNF	Colon cancer	MEDIAN	-0.008	-0.169	9.12E-01Insignificant
PCNA	SWI/SNF	Clear Cell RCC	MEDIAN	-0.05	0.286	5.75E-01Insignificant
PCNA	SWI/SNF	Glioblastoma	MEDIAN	0.057	-0.204	1.97E-01Insignificant
PCNA	SWI/SNF	Glioma	MEDIAN	0.345	-0.396	NA Insignificant
PCNA	SWI/SNF	Prostate cancer	MEDIAN	-0.351	-0.026	7.98E-01Insignificant
PCNA	HIPPO	Breast cancer	MEDIAN	0.137	-0.098	1.18E-01Insignificant
PCNA	HIPPO	Colon cancer	MEDIAN	-0.32	0.016	4.07E-01Insignificant
PCNA	HIPPO	Ovarian	MEDIAN	0.136	-0.112	9.82E-01Insignificant
PCNA	HIPPO	Clear Cell RCC	MEDIAN	-0.05	0.007	4.81E-01Insignificant
PCNA	HIPPO	Glioblastoma	MEDIAN	0.113	-0.03	6.86E-01Insignificant
PCNA	HIPPO	Glioma	MEDIAN	0.559	-0.208	NA Insignificant
PCNA	HIPPO	Prostate cancer	MEDIAN	-0.114	-0.128	7.18E-01Insignificant

**Table S2:** Median expression values of PCNA in several cancer in altered and unaltered signalling pathways, retrieved from UALCAN database

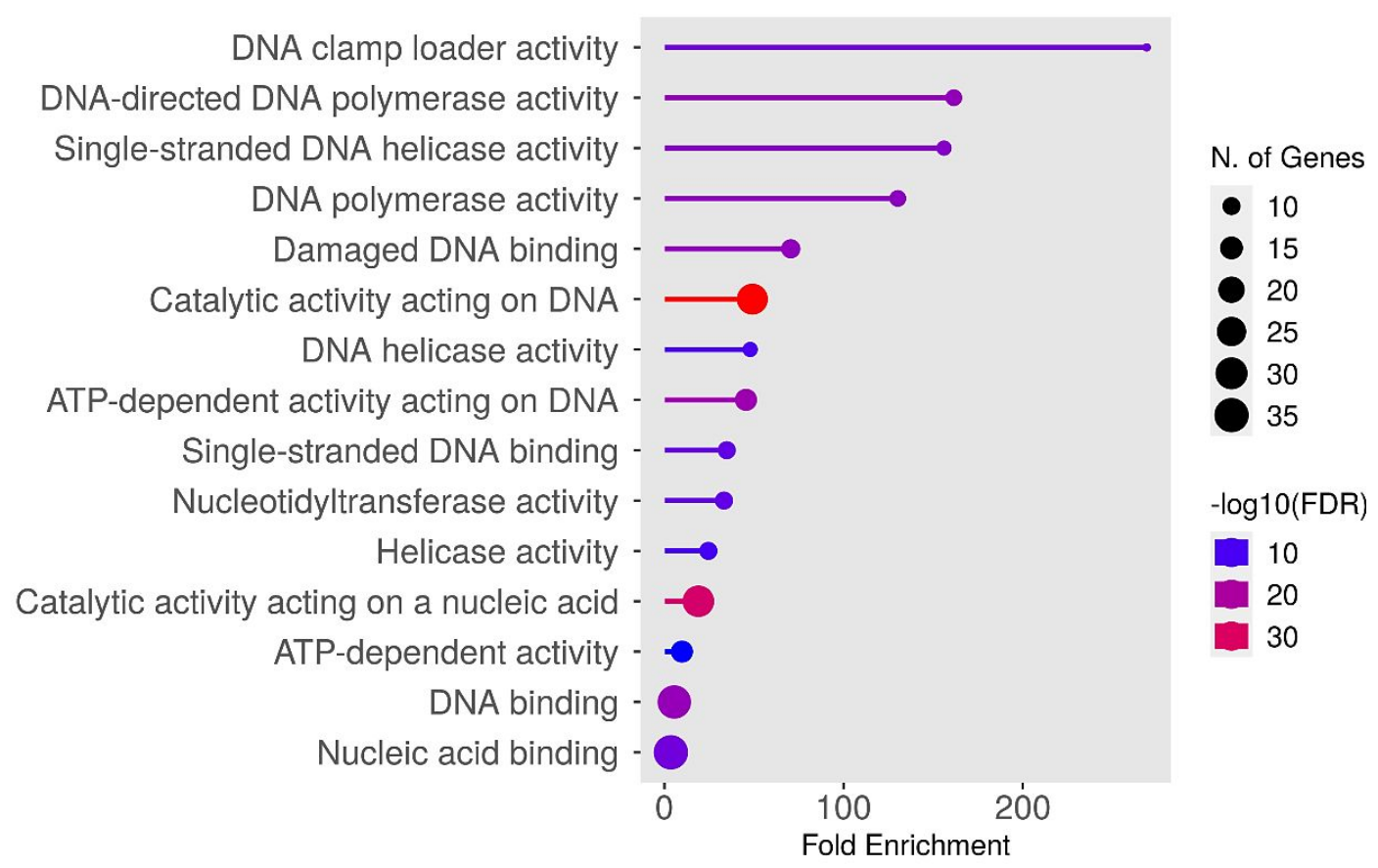
**Supplementary data for heatmap interaction of selected pathways and enriched mapped genes from STRING database (KEGG, Wiki pathways, Reactome) for gene enrichment analysis of PCNA.**



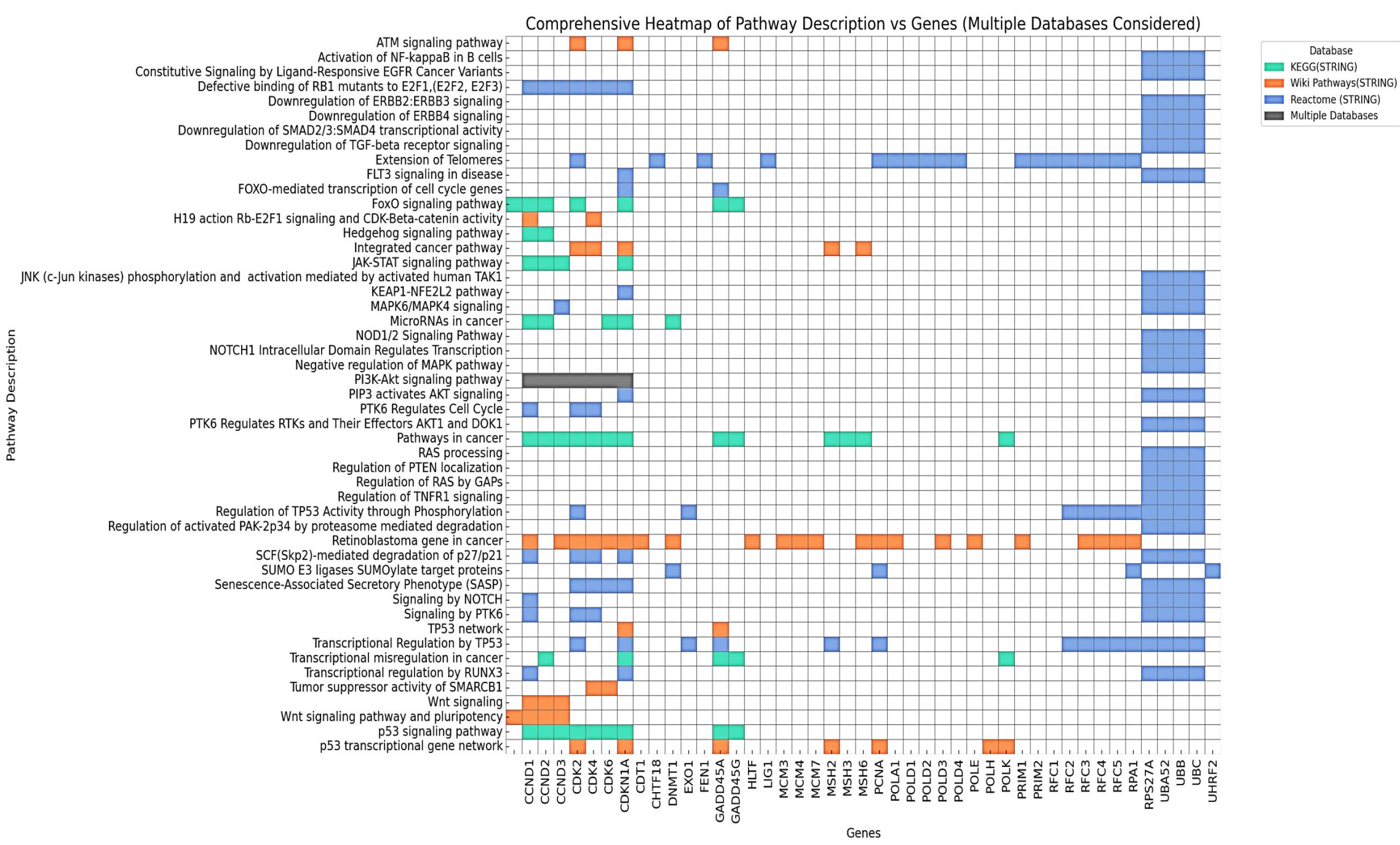
**Supplementary data for ppi network and gene enrichment  
analysis of PCNA.**



e)



f)



**Figure S2** a) Protein-protein interaction network of PCNA with top 50 binding partners. b) GSVA score distribution of PCNA and its interactors in selected cancer types from TCGA dataset. c) Gene ontology (GO) enrichment for biological process of PCNA and its associated partners. d) GO enrichment for cellular localisation. e) GO enrichment for molecular function. f) Heatmap interaction of selected pathways and enriched mapped genes .