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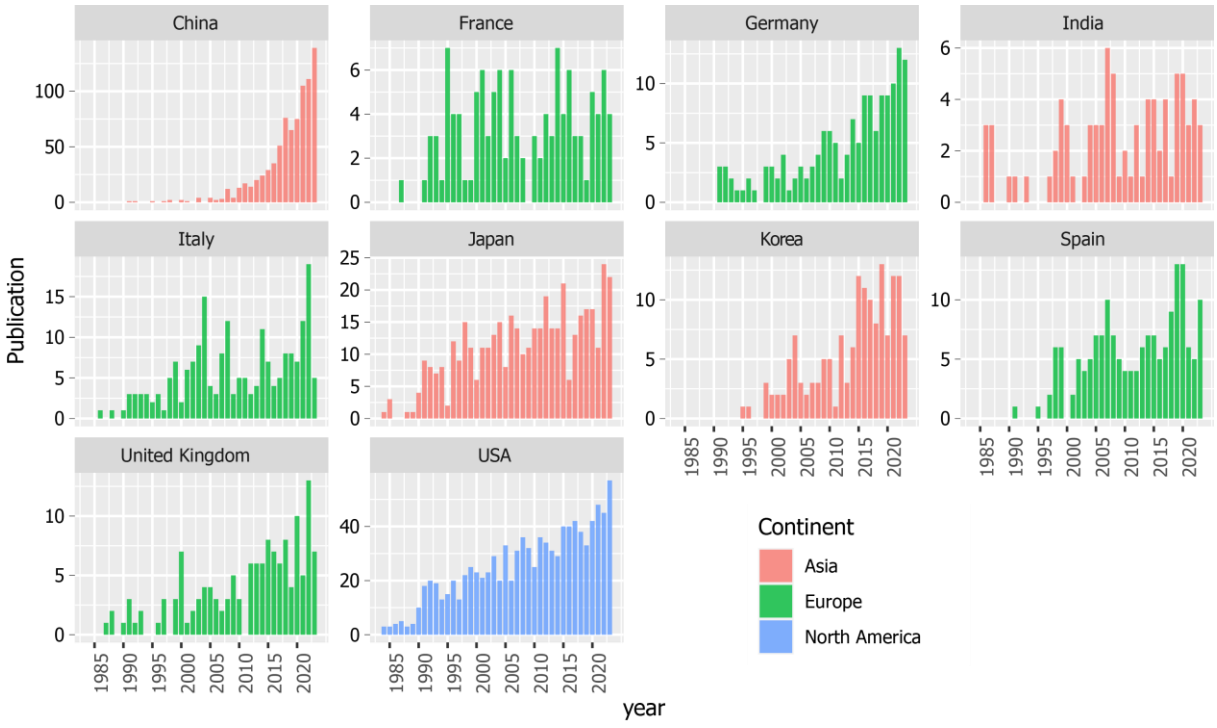
Mapping the evolution of liver aging research: A bibliometric analysis

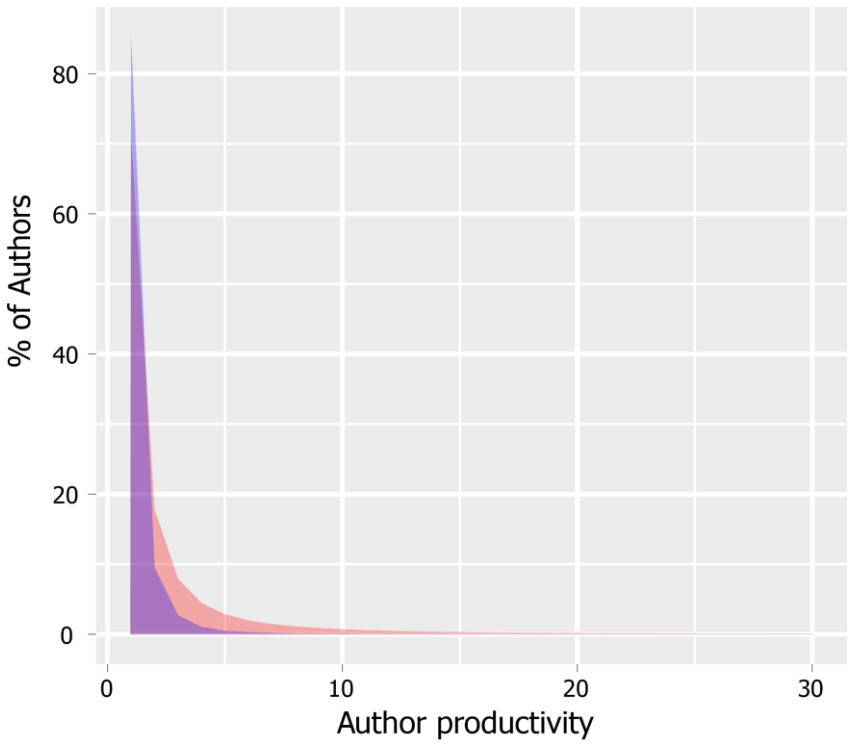
Han QH *et al*. History and trends of liver-aging research

Qun-Hua Han, Shun-Mei Huang, Sha-Sha Wu, Sui-Sui Luo, Zhi-Yuan Lou, Hui Li, Yun-Mei Yang, Qin Zhang, Ji-Min Shao, Li-Jun Zhu

Supplementary Figure

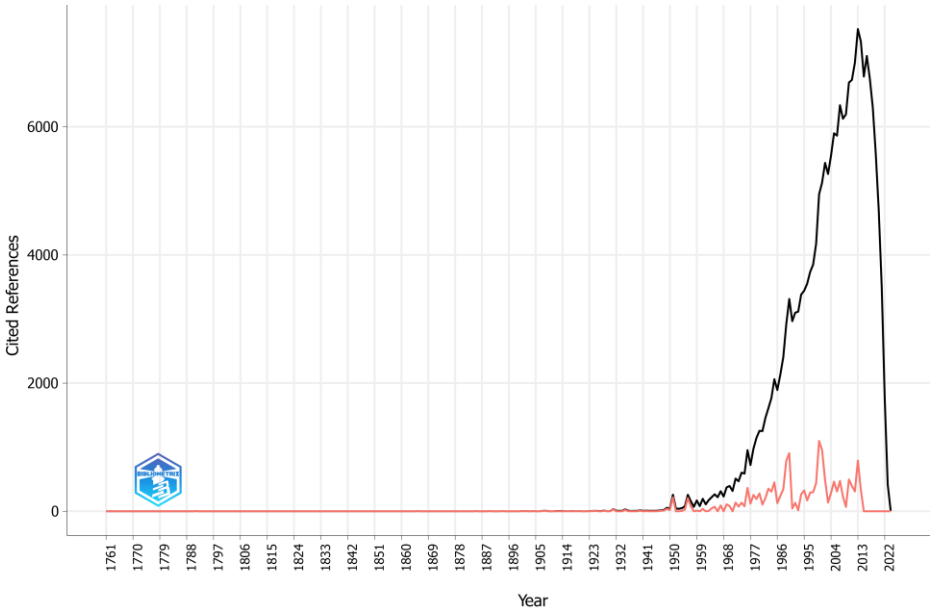


Supplementary Figure 1 The number of articles published per year of the top 10 countries.



Supplementary Figure 2 The frequency distribution of authors publishing a given number of articles.

Supplementary Figure 3 The number of articles published per year by the top 10 journals.



Supplementary Figure 4 Standard reference publication year spectroscopy. The time spans the years from 1761 to 2023.

Supplementary Table 1 The global overview of publications in liver aging research

Global overview	**Number**
Timespan	1984-2023
Total publication	4288
Annual Growth Rate %	0.6
Average citations per article	36.78
Average citations per year per article	3.004
References	135689
Authors collaboration	
Single-authored articles	124
Documents per Author	0.178
Co-Authors per article	7.15
International co-authorships %	23.16
Authors	
Authors	24034

Author Appearances	30677
Authors of single-authored articles	111
Publication Contents	
Keywords Plus (ID)	8933

Supplementary Table 2 The top 10 frequency keywords

Frequency	Centrality	Label	Year
973	0.04	gene expression	1991
743	0.04	liver	1990
712	0.02	oxidative stress	1993
477	0.06	aging	1990
381	0.04	mouse	1990
367	0.04	cell	1990
326	0.04	caloric restriction	1991
309	0.07	disease	1990
293	0.09	metabolism	1990
266	0.06	activation	1990

Supplementary Table 3 Basic characteristics of the 11 clusters in the keywords clustering diagram of related papers in liver aging (1984-2023)

Cluster ID	Size	Silhouette	Mean (Year)	Label (LLR)
0	170	0.543	2001	lipid peroxidation (117.59, 1.0E-4); oxidative stress (115.85, 1.0E-4); free radicals (58.46, 1.0E-4); d-galactose (53.15, 1.0E-4); superoxide dismutase (51.86, 1.0E-4)

1	148	0.622	2010	metabolic syndrome (76.93, 1.0E-4); non-alcoholic fatty liver disease (71.2, 1.0E-4); obesity (69, 1.0E-4); insulin resistance (67.83, 1.0E-4); nonalcoholic fatty liver disease (66.27, 1.0E-4)
2	145	0.543	2006	cellular senescence (138.61, 1.0E-4); senescence (101.69, 1.0E-4); liver cancer (59.71, 1.0E-4); hepatic stellate cell (59.71, 1.0E-4); liver fibrosis (54.71, 1.0E-4)
3	98	0.674	1999	cell (53.05, 1.0E-4); rat liver (50.32, 1.0E-4); age related change (40.56, 1.0E-4); mice (30.54, 1.0E-4); messenger rna (25.05, 1.0E-4)
4	86	0.737	2003	senescence marker protein-30 (40.83, 1.0E-4); oxidative damage (33.47, 1.0E-4); plasma membrane (27.25, 1.0E-4); knockout mice (27.25, 1.0E-4); transgenic mice (21.79, 1.0E-4)
5	54	0.795	1999	age (55.52, 1.0E-4); skeletal muscle (53.13, 1.0E-4); mitochondrial dna (33.44, 1.0E-4); senescence (27.49, 1.0E-4); liver mitochondria (27.05, 1.0E-4)
6	53	0.816	1997	activation (46.73, 1.0E-4); nuclear receptor (23.9, 1.0E-4); identification (23.12, 1.0E-4); transcription factor (22.17, 1.0E-4); transcription factors (17.92, 1.0E-4)
7	48	0.737	2003	oxidative stress (26.64, 1.0E-4); invivo (18.95, 1.0E-4); protein turnover (17.82, 1.0E-4); muscle (13.67, 0.001); tissue (13.01, 0.001)

8	41	0.793	2008	alzheimers disease (42.82, 1.0E-4); cognitive impairment (34.37, 1.0E-4); cholesterol (17.55, 1.0E-4); model (16.93, 1.0E-4); animal model (15.1, 0.001)
9	40	0.841	2002	expression (52.8, 1.0E-4); gene expression (49.06, 1.0E-4); transcription (32.09, 1.0E-4); extends life span (19.95, 1.0E-4); lipid peroxidation (16.63, 1.0E-4)
10	31	0.884	2015	gut microbiota (51.54, 1.0E-4); bile acid (25.47, 1.0E-4); immunosenescence (23.45, 1.0E-4); gut-liver axis (23.45, 1.0E-4); phenotype (15.63, 1.0E-4)

Silhouette value > 0.5 means the clustering results are reliable; LLR: cluster labels were generated from the keywords lists of cited articles within each cluster using the likelihood ratio statistic ($P < 0.001$). The keyword with the highest association for each cluster is automatically chosen as the cluster name by the software.

Supplementary Table 4 List of 64 genes appeared at least in 8 articles

Genes	Number of articles
TNF	145
SIRT1	77
MTOR	56
BAX	49
MYC	42
CD4	42
HGF	37
JUN	33
PGC	32
STAT3	32

H2AX	31
TERT	29
NQO1	25
SOD2	24
SOD1	24
AR	20
SIRT3	20
IGF1	20
FOXO1	20
FGF21	19
PCNA	19
APOE	19
CYP2E1	17
NLRP3	16
EGFR	14
KEAP1	14
IL6	13
CDK4	12
CCN1	12
PTEN	12
ERCC1	12
CDKN1A	11
BCL2	11
GPX1	11
PPARA	11
BMAL1	11
ATG7	11
TLR4	10
SIRT6	10

CD36	9
TP53	9
CDKN2A	9
FOS	9
CD34	9
ATG5	9
AFP	9
GCLM	9
FASN	9
LDLR	8
HMGB1	8
TFAM	8
GDF11	8
PER2	8
CYP1A2	8
CD44	8
CD28	8
CD38	8
CCL2	8
ATF4	8
XBP1	8
FOXA2	8
ALB	8
BDNF	8
ATM	8