

Supplementary material 1. Database-specific search strategies and screening documentation

Overview

- **Databases searched:** PubMed, Embase, Scopus, Web of Science.
- **Coverage:** No date restriction.
- **Language:** English only.
- **Study types targeted:** original research (case-control, cohort; clinical trials if applicable)
- **Key conceptual blocks:**
 1. Breast cancer terms
 2. Germline genetic variation terms
 3. Immune-related terms

Scopus

- **Results:** 8,781 documents found.
- **Search date:** [10 March 2025] - (including manuscripts scheduled for full publication in 2026)
- **Search fields:** [All fields]
- **Filters applied:** [limited to English], [limited to article], [limited to final] and [excluded book series]

The query string below incorporates all of the filters listed above, which are therefore applied automatically.

Exact query (as run) on advanced search:

```
( TITLE-ABS-KEY ( ( "breast cancer" OR "breast neoplasm*" OR "breast tumo?r*" OR "breast carcinoma*" OR "mammary cancer" OR "mammary neoplasm*" OR "mammary tumo?r*" OR "mammary carcinoma*" ) AND ( "genetic variant*" OR "genetic polymorphism*" OR polymorph* OR variant* OR snp* OR snv* OR mutation* OR genotype* OR haplotype* ) ) AND ALL ( "immune response" OR immunity OR immunosurveillance OR immunomodulation OR "tumor microenvironment" OR "tumour microenvironment" OR "immune microenvironment" OR TME OR microenvironment* ) ) AND ( LIMIT-TO ( PUBSTAGE , "final" ) ) AND ( LIMIT-TO ( DOCTYPE , "ar" ) ) AND ( EXCLUDE ( SRCTYPE , "k" ) )
```

The screenshot displays the Scopus search interface. At the top left is the Scopus logo. The navigation bar includes 'Search', 'Sources', 'SciVal', and buttons for 'Create account' and 'Sign in'. An 'Advanced query' toggle is turned on. The search query is displayed in a text box, matching the one provided in the text above. Below the query box are links for 'Save search', 'Set search alert', and 'Edit in advanced search'. At the bottom, there are tabs for 'Documents', 'Preprints', and 'Secondary documents', with 'Preprints' marked as 'Beta'. The search results show '8,781 documents found' and a link to 'Analyze results'.

PubMed

- **Results:** 48,342 documents found.
- **Search date:** [30 March 2025]
- **Search fields:** [All fields]
- **Filters applied:** [No filter]

Exact query (as run):

((breast OR mammary) AND (cancer OR neoplasm* OR tumor* OR carcinoma*)) AND (genet* OR polymorph* OR variant* OR SNP OR SNPs OR SNV OR SNVs OR mutation*) AND (immun* OR immunosurveillance OR immunomodulation OR (tumor AND microenvironment))

NIH National Library of Medicine
National Center for Biotechnology Information

Log in

PubMed®

((breast OR mammary) AND (cancer OR neoplasm* OR tumor* OR carcinoma*)) AND (genet* OR polymorph* OR variant* OR SNP OR SNPs OR SNV OR SNVs OR mutation*) AND (immun* OR immunosurveillance OR immunomodulation OR (tumor AND microenvironment))

Advanced Create alert Create RSS Search User Guide

Save Email Send to Sort by: Best match Display options

MY CUSTOM FILTERS

48,342 results Page 1 of 4,835

RESULTS BY YEAR

1959 2025

Filters applied: from 1900 - 2025/3/30. [Clear all](#)

1 **A single-cell RNA expression atlas of normal, preneoplastic and tumorigenic states in the human breast.**

Cite Pal B, Chen Y, Vaillant F, Capaldo BD, Joyce R, Song X, Bryant VL, Penington JS, Di Stefano L, Tubau Ribera N, Wilcox S, Mann GB; kConFab; Papenfuss AT, Lindeman GJ, Smyth GK, Visvader JE. EMBO J. 2021 Jun 1;40(11):e107333. doi: 10.15252/embi.2020107333. Epub 2021 May 5.

Embase

- **Results:** 50,985 documents found.
- **Search date:** [10 March 2025] - (including manuscripts scheduled for full publication in 2026)
- **Search fields:** [All fields]
- **Filters applied:** limited to humans ([humans]/lim), limited to Embase records ([embase]/lim), and reviews were excluded (NOT [review]/lim).

The query string below incorporates all of the filters listed above, which are therefore applied automatically.

Exact query (as run) on advanced search:

```
('breast cancer'/exp/mj OR ((breast:ti,ab,kw OR mammary:ti,ab,kw) AND (cancer*:ti,ab,kw OR neoplasm*:ti,ab,kw OR tumo?r*:ti,ab,kw OR carcinoma*:ti,ab,kw OR malignan*:ti,ab,kw))) AND ('genetic variation'/exp OR 'polymorphism'/exp OR 'single nucleotide polymorphism'/exp OR 'mutation'/exp OR polymorph*:ti,ab,kw OR variant*:ti,ab,kw OR snp*:ti,ab,kw OR snv*:ti,ab,kw OR mutation*:ti,ab,kw OR genotype*:ti,ab,kw OR haplotype*:ti,ab,kw) AND ('immune response'/exp OR 'immunity'/exp OR 'tumor microenvironment'/exp OR ((immun* NEAR/10 (cancer* OR neoplasm* OR tumo?r* OR microenvironment*)):ti,ab,kw) OR 'immune response':ti,ab,kw OR immunity:ti,ab,kw OR immunosurveillance:ti,ab,kw OR immunomodulation:ti,ab,kw OR 'tumor microenvironment':ti,ab,kw OR microenvironment*:ti,ab,kw) AND [humans]/lim AND [embase]/lim NOT [review]/lim
```

Note: Records were exported from Embase in RIS format and imported into Rayyan. A one-record discrepancy was observed (Embase export n = 50,985; Rayyan indexed n = 50,984). The unmatched item could not be identified with certainty (likely due to RIS parsing/metadata normalization issues, e.g., incomplete fields or encoding anomalies). Thus, 50,984 records proceeded to screening.

The screenshot shows the Embase search interface. At the top, the search query is displayed in a text box. Below the query, there are navigation tabs for Search, Emtree, Journals, Results, and My tools. The Results tab is active, showing a list of search results. The first result is highlighted, showing the search number #1 and the total number of results, 50,985. The search filters are visible on the left side of the page, including Sources, Drugs, Diseases, Devices, Floating Subheadings, and Age. The search results are displayed in a table format, with columns for search number, title, and number of results. The search filters are applied to the search results, and the search results are displayed in a table format.

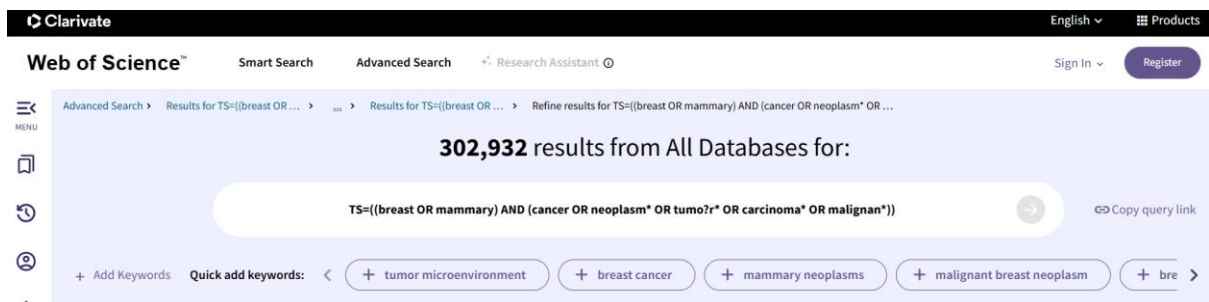
Web of Science

- **Results:** 302,932 documents found.
- **Search date:** [10 March 2025]
- **Search fields:** [All fields]
- **Filters applied:** [No filter]

Exact query (as run) on Advanced Search (Query builder):

```
TS=((breast OR mammary) AND (cancer OR neoplasm* OR tumo?r* OR carcinoma* OR
malignan*))
AND
TS=(
(polymorph* OR variant* OR SNP OR SNPs OR SNV OR SNVs OR mutation* OR
genotype* OR haplotype*)
OR
(immun* NEAR/10 (cancer OR neoplasm* OR tumo?r* OR microenvironment*))
OR
("immune response" OR immunity OR immunosurveillance OR immunomodulation OR
"tumor microenvironment" OR microenvironment*)
)
```

(including manuscripts scheduled for full publication in 2026)



The screenshot displays the Web of Science search results page. At the top, the Clarivate logo is visible on the left, and 'English' and 'Products' are on the right. The main navigation bar includes 'Web of Science', 'Smart Search', 'Advanced Search', and 'Research Assistant'. Below this, the search results are shown for the query: **302,932 results from All Databases for:** `TS=((breast OR mammary) AND (cancer OR neoplasm* OR tumo?r* OR carcinoma* OR malignan*))`. A 'Copy query link' button is present next to the query. Below the query, there is a 'Quick add keywords' section with buttons for 'tumor microenvironment', 'breast cancer', 'mammary neoplasms', 'malignant breast neoplasm', and 'bre'.

Screening workflow documentation

- **Screening tool/software:** [Rayyan (<https://www.rayyan.ai>)]
- **Deduplication approach:** [python data wrangling; (github.com/MuriloPorfirio/Integrative_Review_Tools)]
- **Title/abstract screening:**
 - Reviewers: 2 independent reviewers (M.P.A, J.H.V)
 - Disagreements resolved by: J.F.V
- **Full-text assessment:**
 - Reviewers: 2 independent reviewers (M.P.A, J.H.V)
 - Disagreements resolved by: J.F.V

Full-text exclusions (n = 18)

Studies were excluded after full-text assessment for one of the following reasons: out of the immune-gene scope; tumor-only (somatic) profiling; expression/omics-only without germline variant testing; pharmacogenetic/metabolic focus; abstract only; or full text unavailable.

| Study | Reason |
|--|--|
| Role of GATA3 exon 6 germline mutations in breast cancer progression in Egyptian female patients | Out of the immune-gene scope |
| An analysis of the prognostic role of reactive oxygen species-associated genes in breast cancer | Expression/omics-only (no germline variants) |
| Case-control study on the fibroblast growth factor receptor 2 gene polymorphisms associated with breast cancer in Chinese Han women | Out of the immune-gene scope |
| Exome sequencing in a breast cancer family without BRCA mutation | Tumor-only/somatic profiling |
| Mu-Opioid Receptor Polymorphisms and Breast Cancer in a Korean Female Adult Population: A Retrospective Study | Out of the immune-gene scope |
| Effects of Infection-Induced Fever and the Interaction with IL6 rs1800796 Polymorphism on the Prognosis of Breast Cancer | Out of scope for review outcomes |
| Programmed death-ligand 1 single-nucleotide polymorphism affects breast cancer chemosensitivity and adverse events in the neoadjuvant setting | Out of scope for review outcomes |
| Higher circulating levels of chemokine CCL22 in patients with breast cancer: evaluation of the influences of tumor stage and chemokine gene polymorphism | Expression/biomarker-focused (no germline variants as primary aim) |
| The polymorphisms in Toll-like receptor genes and cancer risk | Review/non-original study |
| Combined effect of CYP1B1, COMT, GSTP1, and MnSOD genotypes and risk of postmenopausal breast cancer | Pharmacogenetic/metabolic focus |
| Innate immunity-related sequence variants as predictors of breast cancer risk among women of African descent | Abstract only |
| Functional polymorphism rs7072793 C>T affects individual susceptibility to breast cancer by modulating CD25 transcription activity | Full text unavailable |
| Genomic and immune profiling of breast cancer brain metastases | Abstract only |
| Multiomics in disparities research: Identifying African ancestry-specific mechanisms in the triple negative breast cancer tumor microenvironment | Abstract only |
| Relationship of the Breast Ductal Carcinoma In Situ Immune Microenvironment with Clinicopathological and Genetic Features | Tumor-only/somatic profiling |
| Targeted next-generation sequencing identifies clinically relevant somatic mutations in a large cohort of inflammatory breast cancer | Tumor-only/somatic profiling |
| Integrative multi-omics analyses unravel the immunological implication and prognostic significance of CXCL12 in breast cancer | Expression/omics-only (no germline variants) |
| Role of ICAM1 in tumor immunity and prognosis of triple-negative breast cancer | Expression/omics-only (no germline variants) |