

The Periodontal Interface - An Audit and Living Inventory

Working draft version 0.2 · Updated 13 October 2026 · Companion resource to the Cybernetic Hypothesis of Periodontal Disease in Mammalian Carnivores

276 entries connecting environment, gums and the wider animal

What meets at the gum interface - and what changes when that interface changes?

This working inventory brings together anatomy, physical forces, food and environmental exposures, local chemistry, microbes, circulation, immunity, lymph drainage and neural signalling. It considers their occurrence, quantity, quality, frequency, clearance and potential feedback, including consequences extending into behaviour and the wider environment.

The purpose is to help researchers frame better questions about relationships across compartments, species and time. Colour coding distinguishes documented component studies, proposed research priorities and entries awaiting further citation work.

This is an evolving research resource. Corrections, additional variables, species-specific evidence and proposals for testing connected mechanisms are welcome.

The word **gum** here includes the visible gingiva and its connected crevice, attachment, supporting tissues, vessels, lymphatics and nerves. Blood normally stays within vessels. Lymph drains underlying tissues. A blood constituent or systemic condition is therefore not automatically a substance in direct contact with the exposed gum surface.

276 entries across 12 categories. 87 entries linked to supporting sources; 189 entries awaiting precise citation audit.

Scope of this draft. Entries include substances, cell populations, anatomical structures, measurable properties, processes, exposures, events, context variables and outputs. They are not 276 independent mechanisms or a census of individual molecules. Some entries are families that require expansion. The count reveals the scope of the audit; it does not establish that gums are more complex than every other interface.

Evidence boundary. "Supporting source identified" means an entry is linked to a study or resource addressing the named item in the stated context. The 87 source-linked entries draw on shared references; they are not 87 independently validated mechanisms. A link does not certify the proposed timing, every suggested measurement, causality, or occurrence in every mammal. "Citation pending" means the exact identity, compartment, species and supporting primary record still need a row audit. In the final output category, proposed ecological consequences are explicitly labelled as candidates.

Two distinctions to retain

Beneficial and harmful are outcomes; positive and negative feedback describe system behaviour. Positive feedback amplifies a change. Negative feedback counteracts it. Either can have helpful or harmful consequences depending on the starting state, scale and time horizon.

Equal total exposure does not guarantee equal biological effect. Repeated small exposures may accumulate, maintain inflammation or change responsiveness. A large pulse may cross a threshold that separated small exposures never reach. Recovery, clearance, peaks, sequence and prior injury must be recorded alongside cumulative dose. A small initiating perturbation can have large consequences where an amplifying loop exists; that loop must be demonstrated.

How to read the timing and colours

Occurrence codes are **provisional working descriptors, not measured prevalence or proof of continuous molecular detection**. Specify the species, individual, tooth, compartment and observation interval before assigning a final code. An exposure can be absent entirely. Different animals may have different codes for the same variable.

Code	Meaning	How to use it
C	Continuous or ongoing under the stated condition	A structure, supply, capacity or state persists. Its concentration or activity may fluctuate.
R	Recurrent or intermittent	Meals, chewing, cleaning, pulses, secretion and activation episodes. Record the actual frequency.
I	Infrequent or discrete event	Blow, fracture, surgery or unusual exposure. It is not an estimate of population incidence.
C if present	Persistent conditional state	A pocket, retained foreign body or altered tooth geometry can persist once established.
C/R or R/I	Combination or context dependent pattern	Separate baseline presence from activation; distinguish the initiating event from lasting consequences.

Marker	Meaning	Interpretation
[F]	Named variable measurement or focused mechanism documented	Closest practical marker for component or reductionist work. It describes a cited study feature, not a permanent property of the variable. A panel or larger systems study may also contain these measurements.
[P]	Proposed priority for connected or temporal research	Editorial research nomination. The variable may already be extensively studied. P does not mean unstudied, proven important, or beneficial.
[F] [P]	Both statuses apply	A studied component can still be a useful candidate for feedback, clearance, timing or comparative work.
[D]	Supporting source identified	The Evidence column links a primary study or curated resource and identifies its scope.
[U]	Precise citation pending	A contributor should verify identity, compartment and species. Absence of F is not evidence that no relevant studies exist.

The colours do not rank danger, benefit or causal certainty. Text codes remain usable in black and white. Research nominations are deliberately broad at this stage and will need prioritisation by feasibility and scientific value.

Inventory contents

Category	Entries
Anatomy and tissue architecture	24
Physical conditions and mechanical inputs	22
Local fluids ions gases and chemical conditions	28
Circulation metabolites hormones and systemic inputs	42
Immune cells inflammatory mediators and tissue regulation	41
Lymph drainage repair and clearance	14
Neural electrical and behavioural regulation	16
Microbial communities and microbial products	26
Food environmental chemicals and interventions	25
Abrupt injury and persistent consequences	14
Host history and modifiers	12
Interface outputs and wider environmental consequences	12
Total selected entries	276

What to record for every variable

The table proposes measurements rather than normal ranges. A publishable record needs a named species and population, tooth and site, compartment, chemical form or cell state, units, method, detection limit, sampling protocol, and an exact source location. Concentration, total amount and flux are different variables. Messenger RNA, protein abundance and biological activity are different observations.

Audit dimension	Required record
Identity and quality	Species or isoform, strain, particle size, chemical form, active versus inactive fraction, material properties.
Quantity and intensity	Concentration, total amount, delivery rate, force, temperature, contact area or energy with units.
Frequency and duration	Exposure schedule, peaks, interval between episodes, baseline variability and duration of altered state.
Clearance and recovery	Washout, metabolism, drainage, tissue repair, return to baseline and persistence after exposure ends.
Severity and function	Injury, attachment loss, pain, oral function and systemic outcomes; record separately from dose.
History and context	Age, life stage, genetics, prior disease, treatment, diet, medication, metabolic state and husbandry.
Evidence and feedback	Observation, association, intervention or demonstrated loop; source species, confounding, uncertainty and time lag.

Sampling itself can perturb the interface. Probing, bleeding, saliva contamination, time of day, elapsed time since feeding or cleaning, collection duration and sample storage should be part of the study record. A value below detection is not proof of absence.

1 Anatomy and tissue architecture

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
A001	Oral gingival epithelium	Gingiva	C Structure varies with site and species	Thickness; keratinisation; turnover	[D] S01	Not classified
A002	Sulcular epithelium	Crevice wall	C At a tooth with a gingival sulcus	Integrity; thickness; permeability	[U] Citation pending	[P]
A003	Junctional epithelium	Tooth attachment	C Specialised attachment around erupted teeth	Attachment continuity; cell turnover	[U] Citation pending	[P]
A004	Basement membrane	Epithelium and connective tissue	C Composition differs at internal and external interfaces	Continuity; laminin and collagen composition	[U] Citation pending	Not classified
A005	Epithelial cell junctions	Barrier	C/R Present baseline; remodelling and disruption vary	Junctional proteins; permeability	[U] Citation pending	[P]
A006	Gingival sulcus geometry	Tooth and gum boundary	C Depth and width vary among sites	Depth; cross section; accessible volume	[U] Citation pending	[P]
A007	Periodontal pocket geometry	Diseased tooth boundary	C if present Conditional on pocket formation; not a normal feature	Depth; volume; surface area	[U] Citation pending	[P]
A008	Connective tissue fibroblasts	Gingiva	C Cell populations and states differ	Density; transcriptome; activity	[D] S01	Not classified
A009	Collagen matrix	Gingival connective tissue	C/R Present and remodelled; gums do produce collagen	Amount; organisation; turnover	[U] Citation pending	Not classified

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
A010	Elastin and elastic fibres	Connective tissue	C Distribution varies by anatomical site	Density; integrity	[U] Citation pending	Not classified
A011	Proteoglycans and glycosaminoglycans	Extracellular matrix	C/R Matrix constituents; change with inflammation	Composition; hydration; turnover	[U] Citation pending	Not classified
A012	Blood vessel endothelium	Gingival microvasculature	C Within tissue; not an exposed surface contact	Density; activation; permeability	[D] S01	Not classified
A013	Lymphatic endothelium	Gingival lymphatics	C Within tissue; vessels differ in function	Capillary and collecting vessel density	[D] S05	[F] [P]
A014	Periodontal ligament	Tooth support	C Connected supporting tissue beyond free gum margin	Width; fibre organisation; strain	[U] Citation pending	[P]
A015	Cementum surface	Tooth root attachment	C Exposure increases with recession or attachment loss	Integrity; exposure; attachment	[U] Citation pending	Not classified
A016	Alveolar bone	Tooth support	C/R Connected tissue; remodelling throughout life	Height; volume; remodelling	[U] Citation pending	Not classified
A017	Tooth surface roughness	Enamel cementum restoration	C Site dependent; altered by damage or treatment	Roughness; topography; biofilm retention	[U] Citation pending	[P]
A018	Acquired salivary pellicle	Tooth and oral surfaces	C/R Forms and is renewed on exposed surfaces	Composition; thickness; replenishment	[U] Citation pending	Not classified

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
A019	Dental calculus deposits	Tooth and pocket	C if present Conditional on mineralised deposits	Area; volume; surface roughness	[U] Citation pending	Not classified
A020	Gingival recession	Gum margin	C if present Persistent anatomical change once established	Margin position; exposed root area	[U] Citation pending	Not classified
A021	Tooth spacing and crowding	Dental arch	C Species individual and tooth dependent	Contact geometry; interdental access	[U] Citation pending	[P]
A022	Tooth eruption and replacement	Developing dentition	R/I Life stage and species dependent	Stage; eruption rate; replacement history	[U] Citation pending	[P]
A023	Tooth mobility	Tooth support	C/R Physiological mobility differs from pathological increase	Displacement under defined force	[U] Citation pending	Not classified
A024	Restoration or prosthesis margin	Tooth and gum boundary	C if present Human or veterinary dental intervention	Fit; overhang; surface composition	[U] Citation pending	Not classified

2 Physical conditions and mechanical inputs

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
B001	Local temperature	Surface and tissue	C/R Baseline variable with food drink and perfusion changes	Degrees C; peaks; rate of change	[U] Citation pending	[P]
B002	Hot food or fluid contact	Gum surface	R/I Only when exposed; temperature and duration matter	Temperature; contact area; seconds	[U] Citation pending	[P]
B003	Cold food or fluid contact	Gum surface	R/I Only when exposed; cooling may be brief	Temperature; contact area; seconds	[U] Citation pending	[P]
B004	Surface wetness	Salivary film	C/R Typically moist; film varies with behaviour and physiology	Film thickness; wetted area; time dry	[U] Citation pending	[P]
B005	Surface drying episodes	Exposed gingiva	R/I Mouth opening airflow salivary dysfunction or procedures	Duration; film loss; evaporation	[U] Citation pending	[P]
B006	Tissue hydration	Gingival connective tissue	C/R Distinct from surface wetness and whole body hydration	Water content; osmotic state	[U] Citation pending	[P]
B007	Chewing force	Teeth ligament and adjacent gum	R Meals and chewing bouts; species and food dependent	Force; loading rate; cycle count	[D] S03	[F] [P]
B008	Shear and friction from food	Gum and tooth surfaces	R Depends on food texture and contact geometry	Shear stress; displacement; duration	[D] S03	[F] [P]

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
B009	Compression and tissue strain	Periodontium	R/C if abnormal Physiological cycles or sustained abnormal loading	Strain; pressure; recovery time	[U] Citation pending	[P]
B010	Food particle hardness	Food contacting dentition	R Property of material actually eaten	Hardness; fracture force	[U] Citation pending	[P]
B011	Food toughness and fibre structure	Food contacting dentition	R Hardness and toughness are different properties	Fracture energy; fibre orientation	[U] Citation pending	[P]
B012	Particle size and geometry	Food and debris	R Influences contact access and retention	Size distribution; shape; sharpness	[U] Citation pending	[P]
B013	Food adhesion and retention time	Tooth and crevice	R/C if retained Changes exposure after the meal ends	Residual mass; clearance time	[U] Citation pending	[P]
B014	Salivary fluid shear	Surface film	C/R Flow is variable and may be very low	Flow rate; shear; clearance	[U] Citation pending	[P]
B015	Tongue cheek and lip contact	Gum surface	R Movement and resting contact differ	Contact frequency; pressure	[U] Citation pending	Not classified
B016	Toothbrushing contact	Tooth and gum surface	R Only in individuals receiving brushing	Force; filament type; strokes; duration	[D] S12	Not classified
B017	Interdental cleaning contact	Interdental surfaces	R/I Conditional on cleaning behaviour	Device; force; frequency; access	[U] Citation pending	Not classified

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
B018	Professional scaling or debridement	Tooth and pocket	I/R Procedure dependent; can cause transient injury	Technique; instrumentation; area treated	[U] Citation pending	Not classified
B019	Gingival massage or manipulation	Gum surface	R/I Exposure is identifiable; independent benefit needs testing	Force; duration; perfusion and injury response	[U] Citation pending	[P]
B020	Bruxism or abnormal repetitive loading	Teeth and supporting tissues	R Behaviour dependent; not a universal periodontal cause	Episode count; force; coexisting inflammation	[U] Citation pending	Not classified
B021	Orthodontic force	Ligament and supporting tissues	C/R if present Applied treatment rather than baseline contact	Force direction; magnitude; duration	[U] Citation pending	Not classified
B022	Local tissue swelling pressure	Inflamed gingiva	C/R if present Oedema changes tissue mechanics	Volume; interstitial pressure	[U] Citation pending	[P]

3 Local fluids ions gases and chemical conditions

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
C001	Salivary film volume	Gum surface	C/R Presence and volume vary; low flow can persist	Film volume; replenishment rate	[U] Citation pending	[P]
C002	Salivary flow rate	Oral fluid supply	C/R Resting stimulated and species specific patterns	mL per minute; circadian profile	[U] Citation pending	[P]
C003	Gingival crevicular fluid volume	Gingival sulcus or pocket	C/R Often low in health; increases with inflammation	Volume per site and collection time	[D] S07	[F] [P]
C004	Gingival crevicular fluid outflow	Crevice to mouth	C/R Flux differs from concentration	Volume per site per time	[D] S07	[F] [P]
C005	Interstitial fluid exchange	Gingival tissue	C Ongoing exchange with vessels and lymph	Flux; pressure; tracer transport	[U] Citation pending	[P]
C006	Water	Saliva crevicular fluid and tissue	C/R Essential constituent; availability varies	Volume fraction; intake; water activity	[U] Citation pending	Not classified
C007	Local pH	Saliva biofilm crevice	C/R Different compartments can have different pH	pH profile; minima maxima; recovery	[U] Citation pending	[P]
C008	Buffering capacity	Saliva and local fluid	C/R Capacity differs from measured pH	Acid titration; recovery after challenge	[U] Citation pending	[P]

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
C009	Bicarbonate	Saliva and tissue fluids	C/R Concentration depends on secretion and exchange	Concentration; buffering contribution	[U] Citation pending	Not classified
C010	Phosphate	Saliva and tissue fluids	C/R Speciation depends on pH	Concentration; species; mineral saturation	[U] Citation pending	Not classified
C011	Sodium	Crevice fluid and saliva	C/R Measured in humans; concentration is site and state dependent	Concentration; total amount; fluid flow	[D] S04	[F]
C012	Potassium	Crevice fluid and saliva	C/R Measured in humans; not a fixed concentration	Concentration; total amount; fluid flow	[D] S04	[F]
C013	Calcium	Crevice fluid and saliva	C/R Measured total elemental calcium; free ion needs separate assay	Total and ionised fractions	[D] S04	[F]
C014	Magnesium	Crevice fluid and saliva	C/R Measured elemental abundance in human oral fluids	Concentration; speciation	[D] S04	[F]
C015	Chloride	Saliva and tissue fluids	C/R Major electrolyte; exact gum site source still needed	Concentration; osmotic contribution	[U] Citation pending	Not classified
C016	Osmolality	Surface and tissue fluids	C/R Changes with secretion evaporation and solute load	mOsm per kg; gradients	[U] Citation pending	[P]
C017	Dissolved oxygen and oxygen tension	Biofilm crevice and tissue	C/R Strong spatial gradients; not equivalent to ambient air	Partial pressure; depth profile	[U] Citation pending	[P]

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
C018	Carbon dioxide	Oral fluids and tissue	C/R Respiration exchange and microbial metabolism contribute	Partial pressure; concentration	[U] Citation pending	Not classified
C019	Redox potential	Biofilm and crevice	C/R Spatially and temporally variable	mV under defined reference conditions	[U] Citation pending	[P]
C020	Mucins	Salivary film	C/R Molecular composition differs across species	Concentration; glycosylation; viscosity	[U] Citation pending	Not classified
C021	Fluid viscosity	Salivary film	C/R Depends on mucins water and shear conditions	Viscosity curve; lubrication	[U] Citation pending	[P]
C022	Salivary amylase	Saliva	C/R if present Marked species and diet differences; not universal in carnivores	Enzyme activity; concentration	[U] Citation pending	Not classified
C023	Secretory immunoglobulin A	Saliva and mucosal surface	C/R Antibody specificity and amount vary	Concentration; antigen binding	[U] Citation pending	Not classified
C024	Lysozyme	Oral fluids	C/R Species and compartment dependent	Concentration; antimicrobial activity	[U] Citation pending	Not classified
C025	Lactoferrin	Oral fluid and neutrophil products	C/R Sources and iron saturation differ	Concentration; iron binding; activity	[U] Citation pending	Not classified
C026	Salivary peroxidases	Saliva	C/R Enzyme family; species dependent composition	Activity; substrate availability	[U] Citation pending	Not classified

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
C027	Defensins	Epithelium and local fluid	C/R Expression and release vary by peptide and state	Individual peptide abundance; activity	[U] Citation pending	Not classified
C028	Cathelicidin LL37 or species homologues	Local tissue and fluid	C/R Use the correct species homologue	Peptide abundance; cleavage; activity	[U] Citation pending	Not classified

4 Circulation metabolites hormones and systemic inputs

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
D001	Local blood perfusion	Gingival microvasculature	C/R Blood normally remains within vessels	Flow; oxygen delivery; pulsatility	[U] Citation pending	[P]
D002	Vascular permeability	Gingival microvasculature	C/R Selective exchange changes with inflammation	Tracer leak; protein flux	[U] Citation pending	[P]
D003	Erythrocytes and haemoglobin	Blood; surface if bleeding	C in vessels R at surface Surface blood is conditional on bleeding or injury	Cell count; haemoglobin; contamination	[U] Citation pending	Not classified
D004	Platelets	Blood and injury site	C in vessels R at injury Local activation differs from circulation	Count; activation; clot formation	[U] Citation pending	Not classified
D005	Albumin	Blood interstitium and crevicular fluid	C/R Compartment concentrations differ	Concentration; leakage; fluid volume	[U] Citation pending	Not classified
D006	Fibrinogen and fibrin	Blood and injury site	C/R Fibrin deposition is conditional on coagulation	Amount; clot architecture; breakdown	[U] Citation pending	Not classified
D007	Transferrin	Blood and exchanged fluid	C/R Iron carriage; local availability needs compartment assay	Concentration; saturation	[U] Citation pending	Not classified
D008	Free haem and haem availability	Blood products and biofilm	R/C if available Distinct from intact erythrocytes; often altered by bleeding	Free haem; source; uptake	[U] Citation pending	[P]

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
D009	Glucose	Blood interstitium and crevicular fluid	C/R GCF measurement documented in humans	Concentration; peaks; paired blood values	[D] S10	[F] [P]
D010	Urea	Blood saliva and crevicular fluid	C/R GCF occurrence studied in humans	Concentration; flux; ammonia generation	[D] S11	[F] [P]
D011	Lactate	Tissue and oral fluids	C/R Host and microbial origins may overlap	Concentration; production and clearance	[U] Citation pending	[P]
D012	Succinate	Local metabolites	C/R if detected Exact presence and source must be confirmed by compartment	Targeted assay; isotopic source tracing	[U] Citation pending	[P]
D013	Acetate	Biofilm and oral fluids	C/R if detected Microbial and dietary contributions vary	Concentration; flux	[U] Citation pending	Not classified
D014	Propionate	Biofilm and oral fluids	C/R if detected Conditional on community metabolism	Concentration; flux	[U] Citation pending	Not classified
D015	Butyrate	Biofilm and crevicular milieu	C/R if detected Metabolite effects depend on dose and compartment	Concentration; duration; cellular response	[U] Citation pending	[P]
D016	Amino acids	Tissue and oral fluids	C/R Family entry; expand each named analyte separately	Targeted panel; substrate flux	[U] Citation pending	Not classified
D017	Urate	Blood and oral fluids	C/R Systemic and local chemistry may differ	Concentration; oxidation state	[U] Citation pending	Not classified

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
D018	Glutathione	Cells and crevicular fluid	C/R Human GCF metabolomics reported; reduced and oxidised forms differ	GSH GSSG; ratio; turnover	[D] S14	[F] [P]
D019	Alpha tocopherol	Crevicular fluid	C/R if detected Reported in human GCF metabolomics	Concentration; assay identity	[D] S14	[F]
D020	Dehydroascorbic acid	Crevicular fluid	C/R if detected Reported oxidised vitamin C metabolite	Concentration; redox handling	[D] S14	[F]
D021	Uridine	Crevicular fluid	C/R if detected Reported in human metabolomics	Concentration; verified chemical identity	[D] S14	[F]
D022	Thymidine	Crevicular fluid	C/R if detected Reported in human metabolomics	Concentration; verified chemical identity	[D] S14	[F]
D023	Xanthine	Crevicular fluid	C/R if detected Reported in human metabolomics	Concentration; metabolic context	[D] S14	[F]
D024	Glucose 1 phosphate	Crevicular fluid	C/R if detected Reported in human metabolomics	Concentration; identity confirmation	[D] S14	[F]
D025	Ribose 5 phosphate	Crevicular fluid	C/R if detected Reported in human metabolomics	Concentration; identity confirmation	[D] S14	[F]
D026	Ribulose 5 phosphate	Crevicular fluid	C/R if detected Reported in human metabolomics	Concentration; identity confirmation	[D] S14	[F]
D027	Insulin	Blood and crevicular fluid	C/R Included in human GCF glucoregulatory panel	Concentration; paired systemic values	[D] S09	[F] [P]
D028	C peptide	Crevicular fluid and blood	C/R Included in human GCF glucoregulatory panel	Concentration; paired blood values	[D] S09	[F]

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
D029	Glucagon	Crevicular fluid and blood	C/R Included in human GCF glucoregulatory panel	Concentration; time since feeding	[D] S09	[F]
D030	Glucagon like peptide 1	Crevicular fluid and blood	C/R Included in human GCF glucoregulatory panel	Active and total peptide	[D] S09	[F]
D031	Gastric inhibitory polypeptide GIP	Crevicular fluid and blood	C/R Included in human GCF glucoregulatory panel	Concentration; feeding time	[D] S09	[F]
D032	Ghrelin	Crevicular fluid and blood	C/R Included in human GCF glucoregulatory panel	Acylated and total forms	[D] S09	[F]
D033	Leptin	Crevicular fluid and blood	C/R Included in human GCF glucoregulatory panel	Concentration; body condition	[D] S09	[F]
D034	Resistin	Crevicular fluid and blood	C/R Included in human GCF glucoregulatory panel	Concentration; inflammatory context	[D] S09	[F]
D035	Visfatin NAMPT	Crevicular fluid and blood	C/R Included in human GCF glucoregulatory panel	Concentration; extracellular activity	[D] S09	[F]
D036	Cortisol	Blood saliva and crevicular fluid	C/R Measured in human GCF; circadian and stress variation	Concentration; time of day; paired blood	[D] S08	[F] [P]
D037	Dehydroepiandrosterone DHEA	Blood saliva and crevicular fluid	C/R Measured in human GCF; not interchangeable with DHEAS	Concentration; assay specificity	[D] S08	[F]

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
D038	Estradiol	Blood gingiva and crevicular fluid	C/R Human pregnancy study; life stage and sex dependent	Concentration; reproductive stage	[D] S15	[F] [P]
D039	Progesterone	Blood gingiva and crevicular fluid	C/R Human pregnancy study; species cycles differ	Concentration; reproductive stage	[D] S15	[F] [P]
D040	Noradrenaline norepinephrine	Nerves blood and crevicular fluid	C/R Reported in human GCF metabolomics	Concentration; local versus systemic source	[D] S14	[F] [P]
D041	Advanced glycation end products	Tissues and circulation	C/R if present Accumulation depends on metabolic history	Molecular species; tissue burden	[U] Citation pending	[P]
D042	Systemic hydration status	Whole body to gingiva	C/R Context variable; not identical to gum surface wetness	Fluid balance; plasma osmolality	[U] Citation pending	[P]

5 Immune cells inflammatory mediators and tissue regulation

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
E001	Neutrophils	Gingiva crevice and circulation	C/R Human healthy tissue and periodontitis characterised	Counts; migration; activation	[D] S02	[F] [P]
E002	Monocytes and macrophages	Gingival tissue and blood	C/R Phenotype and recruitment vary	Counts; phagocytosis; phenotype	[D] S02	Not classified
E003	Dendritic cells	Gingival tissue	C/R Human antigen presenting network characterised	Subsets; antigen presentation	[D] S02	Not classified
E004	CD4 T cells	Gingival tissue	C/R Human network characterised; subset balance matters	Counts; phenotype; activation	[D] S02	Not classified
E005	CD8 T cells	Gingival tissue	C/R Human network characterised	Counts; activation; function	[D] S02	Not classified
E006	Th17 cells	Gingival tissue	C/R Human and mouse evidence; functions are state dependent	Counts; IL17 output	[D] S02 S03	[F] [P]
E007	Regulatory T cells	Gingival tissue	C/R Human network includes regulatory populations	Counts; suppressive function	[D] S02	Not classified
E008	B cells	Gingival tissue	C/R Few in healthy samples; disease can change abundance	Counts; activation; antibody repertoire	[D] S02	Not classified
E009	Plasma cells	Gingival tissue	C/R Especially relevant in established inflammation	Counts; antibody secretion	[U] Citation pending	Not classified

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
E010	Mast cells	Gingival tissue	C/R Detected in human immune characterisation	Counts; degranulation	[D] S02	Not classified
E011	Innate lymphoid cells	Gingival tissue	C/R Small population reported in human barrier study	Subsets; activation; cytokines	[D] S02	Not classified
E012	Immunoglobulin G	Blood crevicular fluid and tissue	C/R Antibody specificity and access vary	Amount; specificity; function	[U] Citation pending	Not classified
E013	Immunoglobulin M	Blood crevicular fluid and tissue	C/R Compartment and antigen specificity matter	Amount; specificity; function	[U] Citation pending	Not classified
E014	Interleukin 1 beta	Gingiva and crevicular fluid	C/R Human GCF measurement documented	Amount per site; concentration; activity	[D] S16	[F] [P]
E015	Interleukin 6	Gingiva and crevicular fluid	C/R Mechanical induction studied; GCF measurement also documented	Production; concentration; timing	[D] S03 S17	[F] [P]
E016	Interleukin 17	Gingival immune network	C/R Human responses characterised; mouse mechanical work	Local production; receptor signalling	[D] S02 S03	[F] [P]
E017	Tumour necrosis factor alpha	Gingiva and crevicular fluid	C/R Human GCF measurement documented	Amount per site; activity	[D] S16	[F]
E018	Interleukin 10	Local immune milieu	C/R Precise compartment and species evidence to attach	Concentration; functional response	[U] Citation pending	[P]

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
E019	Interleukin 23	Local immune milieu	C/R Precise source and state need row audit	Concentration; receptor response	[U] Citation pending	[P]
E020	CXCL8 interleukin 8	Gingival cell signals and fluid	C/R Human chemokine; mice use other related chemokines	Concentration; gradient; recruitment	[U] Citation pending	[P]
E021	CCL2 monocyte chemoattractant protein 1	Gingival tissue and fluid	C/R Cell source and disease state vary	Concentration; gradient	[U] Citation pending	Not classified
E022	Complement C3	Blood and local immune interface	C/R Complement dependence tested in mouse oral disease	Abundance; cleavage; activation	[D] S13	[F] [P]
E023	Complement C5a signalling	Local immune interface	R/C if activated Mouse complement receptor mechanism studied	C5a; receptor activity; duration	[D] S13	[F] [P]
E024	Prostaglandin E2	Crevice fluid and tissue	C/R Human GCF measurement through menstrual cycle	Concentration; synthetic activity	[D] S17	[F]
E025	Reactive oxygen species	Activated cells and local milieu	R/C if sustained Family entry; species and source matter	Specific oxidants; production; clearance	[U] Citation pending	[P]
E026	Nitric oxide	Local vascular and immune signalling	C/R Concentration and source determine effect	Metabolites; enzyme activity	[U] Citation pending	Not classified
E027	Neutrophil extracellular traps	Crevice and tissue	R/C if sustained Activation process; not constitutively present everywhere	DNA structures; enzymes; clearance	[U] Citation pending	[P]

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
E028	Myeloperoxidase	Neutrophils and released products	C/R Cell content differs from extracellular activity	Activity; localisation	[U] Citation pending	Not classified
E029	Neutrophil elastase	Neutrophils and local fluid	C/R Extracellular activity requires release and inhibitor balance	Activity; inhibitor ratio	[U] Citation pending	Not classified
E030	Matrix metalloproteinase 8	Tissue and crevicular fluid	C/R Named in human GCF panel; cited study concerns apical disease	Active and total enzyme; tissue context	[D] S19	[F]
E031	Matrix metalloproteinase 9	Tissue and local fluid	C/R Activity must be distinguished from protein amount	Active and total enzyme	[U] Citation pending	Not classified
E032	Tissue inhibitor of metalloproteinases 1	Tissue and crevicular fluid	C/R Named in human GCF panel; apical study context	Concentration; enzyme inhibitor balance	[D] S19	[F]
E033	RANKL	Gingiva and crevicular fluid	C/R Localisation and quantity studied in human periodontitis	Amount; membrane and soluble forms	[D] S18	[F] [P]
E034	Osteoprotegerin OPG	Gingiva and crevicular fluid	C/R Human periodontal study; decoy receptor	Concentration; RANKL to OPG relationship	[D] S18	[F] [P]
E035	Osteoclast activity	Alveolar bone	C/R Remodelling baseline; inflammatory activation in models	Resorption; cell counts	[D] S05	[F]
E036	Osteoblast activity	Alveolar bone	C/R Remodelling and repair vary	Formation rate; cell state	[U] Citation pending	Not classified

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
E037	Transforming growth factor beta	Local repair and immune milieu	C/R Family and activation state need specification	Active isoform; cellular response	[U] Citation pending	Not classified
E038	VEGF C	Periodontal tissue and lymphatics	C/R Mouse intervention and human tissue context	Amount; lymphatic functional response	[D] S05	[F] [P]
E039	Plasminogen activator inhibitor 1	Crevice fluid and circulation	C/R Human GCF glucoregulatory panel includes PAI1	Concentration; inhibitory activity	[D] S09	[F]
E040	Tissue plasminogen activator	Crevice fluid	C/R Human GCF menstrual cycle study	Concentration; fibrinolytic activity	[D] S17	[F]
E041	Plasminogen activator inhibitor 2	Crevice fluid	C/R Human GCF menstrual cycle study	Concentration; inhibitory activity	[D] S17	[F]

6 Lymph drainage repair and clearance

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
L001	Initial lymphatic capillaries	Gingival connective tissue	C/R Human tissue and mouse models distinguish vessel classes	Number; area; uptake	[D] S05	[F] [P]
L002	Collecting lymphatic vessels	Periodontal drainage network	C/R Functional collectors differ from capillary counts	Number; smooth muscle coverage; pumping	[D] S05	[F] [P]
L003	Lymph flow and transit time	Gingiva to draining nodes	C/R Local flow impairment studied in mice	Tracer clearance; transit time	[D] S05	[F] [P]
L004	Drainage to cervical lymph nodes	Regional immune circuit	C/R Directly demonstrated in mouse context; species mapping needed	Routes; transit; antigen trafficking	[D] S05	[P]
L005	Lymphatic immune cell transport	Tissue lymph and nodes	C/R Species and cell subtype dependent	Cell flux; transit; activation	[U] Citation pending	[P]
L006	Interstitial oedema	Gingival tissue	C/R if present Altered state from supply and clearance imbalance	Tissue volume; fluid pressure	[U] Citation pending	[P]
L007	Epithelial turnover and shedding	Gingival barrier	C/R Ongoing renewal; site dependent rate	Cell loss; renewal rate	[U] Citation pending	Not classified
L008	Apoptosis and clearance of dead cells	Gingival tissue	C/R Death and removal are distinct variables	Cell death; efferocytosis rate	[U] Citation pending	[P]

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
L009	Autophagy	Gingival cells	C/R Cellular process; flux differs from marker abundance	Autophagic flux; lysosomal activity	[U] Citation pending	Not classified
L010	Collagen synthesis and remodelling	Connective tissue	C/R Wound closure differs from attachment regeneration	Synthesis; degradation; organisation	[U] Citation pending	[P]
L011	Epithelial wound closure	Gingival barrier	R/I Conditional on injury; hours to weeks	Closure rate; barrier function	[U] Citation pending	Not classified
L012	Periodontal attachment repair or regeneration	Tooth support	R/I Not equivalent to surface wound closure	New attachment; ligament and bone architecture	[U] Citation pending	[P]
L013	Salivary and swallowing clearance	Mouth to gastrointestinal tract	C/R Transfers material as well as removing it locally	Clearance time; swallowed load	[U] Citation pending	[P]
L014	Removal by cleaning	Tooth gum and pocket	R/I Intervention changes biofilm and local geometry	Residual biomass; recolonisation; recovery	[U] Citation pending	[P]

7 Neural electrical and behavioural regulation

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
N001	Sensory nerve endings	Gingiva and periodontium	C/R Anatomical presence and firing are different	Density; subtype; firing rate	[D] S06	[P]
N002	Trigeminal afferent signalling	Periodontium to brain	R/C Anatomical pathway persists; activity changes	Spike rate; stimulus response	[U] Citation pending	[P]
N003	Periodontal mechanoreception	Ligament and sensory pathways	R Activated by loading; location is not surface gum alone	Force response; thresholds; adaptation	[U] Citation pending	[P]
N004	Thermal sensory response	Oral sensory pathways	R/I Conditional on temperature change	Threshold; firing; pain score	[U] Citation pending	Not classified
N005	Nociception and pain	Periodontium and nervous system	R/C if sustained Disease can be clinically quiet; no pain does not imply health	Threshold; behaviour; activity	[U] Citation pending	[P]
N006	TRPV1 channel signalling	Sensory cells	R/C Expression differs from channel activation	Expression; activation threshold	[U] Citation pending	[P]
N007	Substance P	Periodontal sensory circuit	C/R Mouse periodontal mechanism tested	Peptide release; receptor response	[D] S06	[F] [P]
N008	Calcitonin gene related peptide CGRP	Periodontal sensory circuit	C/R Presence noted in periodontal nociceptors; effects need model specific sources	Peptide release; receptor response	[D] S06	[P]

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
N009	Neurokinin 1 receptor signalling	Local neuroimmune circuit	R/C if activated Substance P receptor targeted in mouse study	Expression; activation; blockade response	[D] S06	[F] [P]
N010	Sympathetic vascular regulation	Gingival vessels and nerves	C/R Local and systemic autonomic activity interact	Vasomotor response; transmitter release	[U] Citation pending	[P]
N011	Parasympathetic control of salivation	Salivary glands to oral film	C/R Indirect pathway to gum surface through saliva	Stimulated secretion; autonomic response	[U] Citation pending	[P]
N012	Neuronal membrane potentials and action potentials	Nerve membranes	C/R Real electrical signalling; distinguish from hypothetical gum fields	Voltage; frequency; conduction	[U] Citation pending	Not classified
N013	Extracellular ATP signalling	Damaged and activated local cells	R/C Release and clearance are state dependent	ATP concentration; receptor response	[U] Citation pending	[P]
N014	Sensory adaptation and sensitisation	Local and central pathways	R/C if sustained History can change later response	Threshold shift; recovery time	[U] Citation pending	[P]
N015	Jaw motor response and chewing pattern	Neural circuit and oral function	R Pain geometry food and experience modify behaviour	Chewing cycles; side preference; force	[U] Citation pending	[P]
N016	Stress related behaviour and neuroendocrine response	Whole host to oral interface	R/C if sustained Includes systemic context; cortisol is a separate analyte	Stress measures; behaviour; paired hormones	[D] S08	[P]

8 Microbial communities and microbial products

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
M001	Total attached biofilm biomass	Tooth and gum boundary	C/R if present Colonisation varies with site age and cleaning	Biomass; thickness; absolute counts	[U] Citation pending	[P]
M002	Microbial community composition	Supra and subgingival biofilm	C/R Human and dog datasets; communities differ by species	Absolute abundance; composition; function	[D] S20 S21	[P]
M003	Biofilm spatial organisation	Tooth crevice and pocket	C/R Architecture changes gradients and contacts	Imaging; spatial density; thickness	[U] Citation pending	[P]
M004	Extracellular biofilm matrix	Biofilm	C/R Composition varies by community and substrate	Polysaccharides; proteins; extracellular DNA	[U] Citation pending	Not classified
M005	Porphyromonas gingivalis	Selected human oral sites and experimental models	C/R if colonised Not universally present; low abundance effects tested in mice	Absolute counts; strain; activity	[D] S13 S20	[F] [P]
M006	Porphyromonas gulae	Canine oral biofilm	C/R if colonised Detected in healthy and diseased dog contexts; not automatically pathogenic	Absolute counts; strain; host state	[D] S21	[P]
M007	Porphyromonas cangingivalis	Canine oral biofilm	C/R if colonised Canine study; human equivalence must not be assumed	Absolute counts; strain; activity	[D] S21	[P]
M008	Fusobacterium species	Oral biofilm	C/R if colonised Family entry; resolve species and host	Species abundance; spatial interactions	[D] S21	[P]
M009	Treponema species	Oral biofilm	C/R if colonised Species and disease associations vary	Species abundance; activity	[D] S21	Not classified

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
M010	Tannerella species	Oral biofilm	C/R if colonised Species resolution needed across mammals	Species abundance; activity	[D] S21	Not classified
M011	Actinomyces species	Oral biofilm	C/R if colonised Site and species dependent commensal roles	Species abundance; activity	[D] S20 S21	Not classified
M012	Streptococcus species	Selected oral sites	C/R if colonised Human catalogue context; not universal across mammals	Species abundance; activity	[D] S20	Not classified
M013	Prevotella species	Oral biofilm	C/R if colonised Species and host dependent roles	Species abundance; activity	[D] S20 S21	Not classified
M014	Capnocytophaga species	Oral biofilm	C/R if colonised Different species occur in humans and companion animals	Species abundance; activity	[U] Citation pending	Not classified
M015	Candida and other oral fungi	Oral surfaces and biofilm	C/R if colonised Colonisation is conditional; does not establish a causal periodontal role	Culture; fungal load; species	[U] Citation pending	Not classified
M016	Oral viruses and bacteriophages	Oral surfaces tissue and biofilm	C/R if present Broad family entry; host viruses differ from bacterial viruses	Identity; load; replication	[U] Citation pending	[P]
M017	Lipopolysaccharide	Gram negative biofilm and local milieu	C/R if released Structure and activity differ across bacterial species	Amount; structure; receptor activity	[U] Citation pending	[P]
M018	Lipoteichoic acids	Gram positive bacterial products	C/R if present Conditional on producing organisms	Amount; activity	[U] Citation pending	Not classified

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
M019	Peptidoglycan fragments	Biofilm and local tissue	C/R Production access and clearance vary	Fragment identity; flux; receptor response	[U] Citation pending	Not classified
M020	Bacterial proteases including gingipains	Selected biofilm and local fluid	C/R if producers present Name enzyme and producing strain	Enzyme identity; activity; inhibitors	[U] Citation pending	[P]
M021	Bacterial extracellular vesicles	Biofilm and local milieu	C/R if released Origin cargo and transport require specification	Particle count; cargo; uptake	[U] Citation pending	[P]
M022	Hydrogen sulphide	Microbial metabolites in oral fluids and gas	C/R if produced Concentration and location determine significance	Concentration; emission rate	[U] Citation pending	[P]
M023	Methyl mercaptan methanethiol	Oral volatile products	C/R if produced Not interchangeable with total oral odour	Concentration; emission rate	[U] Citation pending	[P]
M024	Ammonia	Biofilm and oral fluids	C/R if produced Urea metabolism is one source	Concentration; pH; substrate flux	[U] Citation pending	[P]
M025	Microbial metabolic pathway activity	Biofilm	C/R Predicted genes are not proof of active metabolism	Transcript proteins and flux; measured metabolites	[D] S22	[P]
M026	Antimicrobial resistance determinants	Colonised biofilm	C/R if present Conditional on strains and exposure history	Genes; susceptibility; transfer	[U] Citation pending	[P]

9 Food environmental chemicals and interventions

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
X001	Food protein	Gum surface food and biofilm substrates	R Meal exposure; retention may extend contact	Mass; digestibility; retention	[U] Citation pending	[P]
X002	Food fat and fatty acid composition	Gum surface and local film	R Diet chemistry and host metabolism differ	Mass; fatty acid profile; retention	[U] Citation pending	Not classified
X003	Fermentable carbohydrate	Food retained on teeth and gum	R Depends on diet; not a universal carnivore exposure	Mass; fermentability; clearance	[U] Citation pending	[P]
X004	Dietary fibre and plant material	Food contacting gum and teeth	R/I Diet and species dependent	Mass; fibre type; mechanical properties	[U] Citation pending	[P]
X005	Food organic acids	Food and surface film	R/I Conditional on food composition	Acid species; pH; contact duration	[U] Citation pending	Not classified
X006	Food mineral content	Food and surface film	R Chemical form and solubility matter	Element amount; bioavailability	[U] Citation pending	Not classified
X007	Food processing and preparation	Food exposure context	R Record actual structure and chemistry rather than label alone	Processing method; texture; moisture	[U] Citation pending	[P]
X008	Drinking water composition	Water contacting mouth	R Water source determines dissolved substances	Intake; pH; ions; contaminants	[U] Citation pending	[P]

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
X009	Feeding frequency and meal duration	Exposure schedule	R Measured behaviour rather than assumed dose	Meals per day; chewing and contact time	[U] Citation pending	[P]
X010	Food deprivation or fasting	Host and exposure schedule	R/I Duration and baseline nutrition matter	Hours; body condition; metabolic response	[U] Citation pending	[P]
X011	Tobacco smoke contact	Oral surface and inhaled exposure	R/I if exposed Mostly human active exposure; passive exposure is different	Product; smoke dose; contact frequency	[U] Citation pending	Not classified
X012	Nicotine	Oral contact and systemic input	R/I if exposed Route differs between smoke oral products and treatment	Dose; route; local and blood levels	[U] Citation pending	Not classified
X013	Tobacco combustion products	Oral surface and systemic input	R/I if exposed Mixture entry; name constituents in later extensions	Chemical panel; deposited dose	[U] Citation pending	Not classified
X014	Ethanol	Food drink or preparation contacting mouth	R/I if exposed Dose concentration and contact time vary	Concentration; dose; duration	[U] Citation pending	Not classified
X015	Acetaldehyde	Local chemical products	R/C if produced Can arise locally from ethanol metabolism	Concentration; production; clearance	[U] Citation pending	[P]
X016	Airborne particles and dust	Exposed oral surface	R/I if exposed Actual oral deposition differs from inhaled dose	Particle size; composition; deposition	[U] Citation pending	Not classified
X017	Caustic acid or alkali exposure	Gum surface	I/R if exposed Accident or repeated exposure; severe chemical injury possible	pH; concentration; area; duration	[U] Citation pending	Not classified

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
X018	Chlorhexidine or other antiseptic	Oral treatment exposure	R/I if used Record agent formulation and treatment context	Concentration; dose; contact; microbiome change	[U] Citation pending	[P]
X019	Systemic antibiotics	Blood to local tissues and microbial ecology	R/I if used Treatment duration and resistance matter	Agent; tissue level; exposure history	[U] Citation pending	[P]
X020	Local antibiotic delivery	Periodontal pocket	R/I if used Route and release kinetics differ from systemic treatment	Agent; concentration time profile	[U] Citation pending	Not classified
X021	Anti inflammatory drugs	Blood and local tissues	R/I if used Different agents act through different mechanisms	Agent; dose; duration; target response	[U] Citation pending	Not classified
X022	Immunosuppressive medication	Systemic input to local immunity	R/C if used Host indication and disease are confounders	Agent; dose; immune effect	[U] Citation pending	Not classified
X023	Drugs reducing salivation	Systemic to oral fluid pathway	R/C if used Medication specific; effect not universal	Drug; dose; salivary response	[U] Citation pending	[P]
X024	Drugs associated with gingival enlargement	Systemic to gingival tissue	R/C if used Agent host susceptibility and plaque interact	Drug; exposure; tissue enlargement	[U] Citation pending	Not classified
X025	Radiotherapy exposure	Head and neck tissues if treated	I/R Treatment course; salivary and vascular consequences may persist	Field; fractionation; total dose	[U] Citation pending	Not classified

10 Abrupt injury and persistent consequences

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
T001	Blow to mouth or jaw	Tooth gum and supporting tissue	I/R A brief initiating event can have lasting consequences	Force; direction; energy; affected structures	[U] Citation pending	[P]
T002	Gingival laceration	Gum surface and tissue	I/R Event duration differs from healing duration	Depth; area; contamination	[U] Citation pending	Not classified
T003	Tooth fracture	Tooth beside gum	I then C if unrepaired Record location; not every fracture injures the periodontium	Fracture type; pulp exposure; geometry	[U] Citation pending	[P]
T004	Sharp broken tooth edge	Persistent local geometry	C/R if present Can repeatedly contact soft tissue after the initiating event	Edge shape; contact; repeated injury	[U] Citation pending	[P]
T005	Tooth luxation or avulsion	Tooth attachment and socket	I Acute attachment injury; consequences can persist	Displacement; attachment loss; viability	[U] Citation pending	Not classified
T006	Jaw fracture or altered bite	Jaw and dental contacts	I then C if altered Consequences extend beyond surface gum	Alignment; loading; chewing function	[U] Citation pending	[P]
T007	Foreign body or grass awn impaction	Crevice gum or tissue	I/R then C if retained Material may remain after initial contact	Identity; depth; duration; inflammation	[U] Citation pending	[P]
T008	Food impaction between teeth	Interdental gum	R/C if retained Repeated retention depends on geometry and food	Mass; location; clearance time	[U] Citation pending	[P]

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
T009	Thermal burn	Gum surface and tissue	I/R Different from normal hot or cold exposure	Peak temperature; time; injured area	[U] Citation pending	Not classified
T010	Chemical burn	Gum surface and tissue	I/R Conditional on injurious concentration and contact	Agent; concentration; time; depth	[U] Citation pending	Not classified
T011	Bleeding episode	Crevice or gum surface	R/I Spontaneous trauma or probing induced episodes differ	Source; duration; volume	[U] Citation pending	[P]
T012	Pulp infection draining near gingiva	Adjacent tooth and local tissues	C/R if present Endodontic origin must be distinguished from marginal periodontitis	Pulp status; tract; organisms	[U] Citation pending	Not classified
T013	Periodontal abscess	Pocket and tissue	I/R/C if unresolved Disease dependent; can have systemic consequences	Location; pus; pain; spread	[U] Citation pending	Not classified
T014	Tooth extraction or periodontal surgery	Tooth socket and tissue	I/R Treatment event with subsequent healing trajectory	Procedure; tissue injury; recovery	[U] Citation pending	[P]

11 Host history and modifiers

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
H001	Species and dentition type	Whole animal context	C Defines anatomy diet and appropriate extrapolation	Species; tooth type; ecological feeding mode	[U] Citation pending	[P]
H002	Age and life stage	Whole host context	C Changes over time; not a substance touching the gum	Age; developmental and reproductive stage	[U] Citation pending	Not classified
H003	Sex and reproductive state	Whole host context	C/R Hormones and cycles differ among mammals	Sex; cycle; pregnancy; lactation	[D] S15	[P]
H004	Genetic variants and inherited susceptibility	Host cells	C Variant effects require specific evidence	Genotype; ancestry; functional phenotype	[U] Citation pending	[P]
H005	Epigenetic state	Local cells	C/R Cell specific and history dependent	Methylation; chromatin; expression	[U] Citation pending	[P]
H006	Diabetes and glycaemic regulation	Systemic to gingival context	C/R if present Human associations and interventions need separate assessment	HbA1c; glucose trajectory; medication	[D] S09 S10	[P]
H007	Renal function and uraemic state	Systemic to local fluid chemistry	C/R if altered Context for urea and other metabolites	Renal measures; local and plasma chemistry	[U] Citation pending	[P]
H008	Body condition and nutritional status	Whole host context	C/R Changes exposure physiology and behaviour	Body condition; nutrients; intake	[U] Citation pending	[P]

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
H009	Prior periodontal disease and treatment	Site history	C as history History persists even when current signs improve	Attachment history; treatment; recurrence	[U] Citation pending	[P]
H010	Prior antimicrobial exposure	Host and microbial history	C as history R exposure Past selection can affect present community	Agent; timing; resistance profile	[U] Citation pending	[P]
H011	Circadian phase and sleep state	Temporal context	R Repeated rhythm; sampling time is essential	Clock time; sleep; saliva and hormone profiles	[U] Citation pending	[P]
H012	Housing husbandry and human care	Wider environment	C/R Food cleaning stress and access to treatment differ	Housing; feeding; cleaning; veterinary history	[U] Citation pending	[P]

12 Interface outputs and wider environmental consequences

These rows extend the audit beyond direct contact. Local and systemic transfer can be studied directly. Proposed effects on reproduction, survival and ecosystems require species specific causal investigation; their inclusion does not establish periodontal disease as a universal driver of mammalian life and death.

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
O001	Changes in local nutrient supply from inflammation	Tissue to biofilm	C/R if inflamed Candidate coupling; identify actual substrate and source	Fluid flux; protein and haem availability	[U] Citation pending	[P]
O002	Altered local oxygen and redox gradients	Host and biofilm microenvironment	C/R Potential feedback with pocket geometry and metabolism	Depth profiles; community activity	[U] Citation pending	[P]
O003	Transient bloodstream entry of oral bacteria	Mouth to systemic circulation	R/I Human brushing and extraction studies; not continuous blood infection	Culture; identity; episode duration	[D] S12	[F] [P]
O004	Export of oral mediators or microbial products	Mouth to systemic compartments	R/C if demonstrated Must establish identity route dose and source for each product	Paired sampling; tracing; clearance	[U] Citation pending	[P]
O005	Swallowed oral microbes and metabolites	Mouth to gastrointestinal tract	R/C Transfer is expected; downstream causal effects need separate proof	Swallowed load; survival; destination	[U] Citation pending	[P]
O006	Altered food selection and chewing behaviour	Animal to feeding environment	R/C if function altered Measure contribution of oral disease versus other illness	Food chosen; intake; handling; chewing	[U] Citation pending	[P]
O007	Oral odour and volatile emission	Mouth to air and other animals	C/R if emitted Emission is measurable; ecological communication effects are candidates	Chemical identity; emission; behavioural response	[U] Citation pending	[P]

ID	Named variable	Compartment or route	Occurrence and qualification	Suggested measurement	Evidence	Study
O008	Microbial transfer through licking biting or shared items	Animal to animals or shared environment	R/I Contact dependent; transmission and establishment are separate	Contact; strain tracking; colonisation	[U] Citation pending	[P]
O009	Changes in grazing browsing or prey handling	Animal to ecosystem	R/C if behaviour altered Hypothesised periodontal contribution; not universal evidence	Handling efficiency; intake; oral disease measures	[U] Citation pending	[P]
O010	Changes in parental provisioning or care	Animal to offspring	R if relevant Research candidate; litter size alone is not recruitment success	Provisioning; oral function; offspring outcomes	[U] Citation pending	[P]
O011	Changes in survival and reproductive performance	Host life history	C/R over lifespan Causal periodontal contribution needs species specific longitudinal study	Survival; breeding success; competing risks	[U] Citation pending	[P]
O012	Changes in vegetation prey populations or nutrient cycling	Population to ecosystem	C/R over ecological time Proposed downstream pathway; not established gum specific effect	Population and ecosystem measures; causal model	[U] Citation pending	[P]

From inventory to a cybernetic audit

A list becomes a cybernetic resource when we record connections and their consequences over time. For each proposed edge, name the source variable, destination variable, direction, delay, dose relationship, clearance, evidence and conditions. A one way association is not yet a feedback loop. To establish a loop, show how the response changes a later input or response.

Starting point	Connection to test	Evidence boundary and useful design
Chewing and mechanical contact	Loading > epithelial signalling > immune state > tissue response > later loading or contact	The mechanical IL6 Th17 link has experimental support S03. The full return path and relevance to carnivore foods require testing. Compare texture and composition independently.

Starting point	Connection to test	Evidence boundary and useful design
Inflammatory fluid and biofilm	Inflammation > changed fluid substrates > changed microbial activity > altered inflammation	Measure substrate flux, absolute microbial abundance and host responses serially; do not infer mechanism from relative sequencing abundance alone.
Drainage and tissue pressure	Inflammation > altered lymph flow > fluid or mediator retention > changed inflammation	S05 supports a lymphatic contribution in models. Test functional clearance alongside capillary and collecting vessel measures.
Neural activation	Local perturbation > neural mediator release > immune or vascular response > changed neural activation	S06 supports a mouse Substance P mechanism. Effects can differ by peptide, model and state; avoid assigning every nerve a protective or destructive role.
Brief injury	Blow > altered tooth geometry > repeated contact or retention > persistent response > altered oral function	Follow event duration separately from geometry, repeated exposure, recovery and oral function. Not every fracture initiates periodontitis.
Systemic metabolic state	Systemic change > local substrate or immune state > periodontal response > possible systemic change	Paired local and blood trajectories plus intervention are needed to distinguish mediation from shared causes. An association with a chronic disease does not establish this entire loop.
Oral function and environment	Altered oral function > changed feeding or provisioning > changed exposure and host condition > later oral state	A comparative research candidate. Separate periodontal disease from tooth wear, age, other illnesses, prey availability and care.
Population and ecosystem	Changed feeding or survival > ecological change > changed resource availability > future host exposure	Proposed larger scale return path. Requires ecological measurements and causal attribution; mammal wide claims would exceed current evidence.

Relationship to existing resources

Existing resources include the expanded Human Oral Microbiome Database S20, the human oral mucosa cell atlas S01, GCF proteome and metaproteome work S23, and combined microbiome metabolome studies S22. They already inventory important parts of this interface and should be linked rather than represented as missing science.

The proposed contribution is a common register across compartments, scales, timing, mechanical exposure, clearance and outputs, with comparative mammalian annotations. A preliminary search has identified these overlapping resources; it has not established that this is the first or only inventory of its kind. A systematic scoping review should precede any novelty claim.

Comparative mammalian scope

Human studies, mouse interventions and canine sequencing are identified in the row qualifications and source notes. They should not be collapsed into a single mammalian evidence label. Other species require their own citations and measurements. A common variable name can conceal different salivary chemistry, organisms, tooth replacement, loading and life history.

Species modules can include ovine periodontal disease associated with broken mouth, canine and feline periodontal disease, and elephant tooth wear and successive replacement. These are proposed modules awaiting dedicated source audit. Elephant replacement and wear must be distinguished from periodontal disease. Carnivore reproduction and parental provisioning are contextual research questions; litter size alone does not measure surviving recruits.

Skin can serve as a supporting comparison of barrier architecture, renewal and contact patterns. Gingiva contains collagen and can synthesise and remodel it; surface wound closure is not the same as regeneration of lost periodontal attachment. The case for this inventory rests on the interface and its connections, rather than a claim that an equal area of skin lacks complexity or systemic relevance.

Maintaining a living resource

This inventory accompanies the [Cybernetic Hypothesis of Periodontal Disease resource page](#). It remains a working draft open to correction and further evidence.

Retain stable IDs. New entries should receive new IDs rather than renumbering existing rows. Split family entries when named molecules or species receive individual records; preserve the parent ID and relationship. Distinguish a new observation from a correction, and retain a dated change log. Display total rows, source-linked entries and candidate connections separately.

Send corrections and contributions through our contact page. Please begin the message with "Interface Audit" and provide the entry ID or proposed new name; species, population, tooth and compartment; primary citation or dataset with an exact table or figure; occurrence information and its observation interval; assay and units; proposed feedback connection; and limitations. The editor should review the supplied source and record its species and compartment scope before marking an entry D or assigning F. P is a research nomination and should retain its rationale and date.

Next audit priorities are precise citations for the U rows; temporal validation of occurrence codes; separation of active and inactive forms; canine, feline and other mammalian evidence; and a small number of connected studies that measure exposure, response, clearance and recovery together. Molecular expansions should use accession IDs and downloadable datasets, rather than growing the list by loosely naming pathways.

Open audit question. Direct wound electric fields, proposed gum specific bioelectric regulators, and individual olfactory or ecosystem feedback mechanisms need targeted evidence reviews before they are promoted as established variables or effects. Neuronal electrical activity is already a distinct inventory entry.

Source register and evidence scope

Supporting references were identified through accessible primary study records, abstracts, indexed full text or the named curated resource. This is not a systematic review or a full reanalysis of supplementary datasets. Each record states what it can support. Further citation audit will add exact source locations and complete bibliographic metadata.

S01 Human oral mucosa cell atlas reveals a stromal neutrophil axis regulating tissue immunity

Williams et al 2021

<https://pmc.ncbi.nlm.nih.gov/articles/PMC8359928/>

Human cell atlas; supports named cell compartments. An atlas is itself integrative work.

S02 Characterization of the human immune cell network at the gingival barrier

Dutzan et al 2016

<https://pmc.ncbi.nlm.nih.gov/articles/PMC4820049/>

Human tissue; cell populations and IL17 response. Presence does not establish constant abundance.

S03 On going Mechanical Damage from Mastication Drives Homeostatic Th17 Cell Responses at the Oral Barrier

Dutzan et al 2017

<https://pubmed.ncbi.nlm.nih.gov/28087239/>

Experimental mouse and human oral work; mechanical damage IL6 and Th17 coupling. Does not establish an optimum food texture for dogs or cats.

S04 Comparing Ionic Profile of Gingival Crevicular Fluid and Saliva as Distinctive Signature of Severe Periodontitis

Romano et al 2022

<https://pmc.ncbi.nlm.nih.gov/articles/PMC8945093/>

Human oral fluids; sodium potassium calcium magnesium detected. Several other assayed elements were below detection; they are not listed as detected here.

S05 Effect of VEGFC on lymph flow and inflammation induced alveolar bone loss

Wang et al 2020

<https://pubmed.ncbi.nlm.nih.gov/32418202/>

Mouse interventions and human gingival tissue. Functional lymph flow differs from vessel number.

S06 Substance P aggravates ligature induced periodontitis in mice

2023 primary study

<https://pmc.ncbi.nlm.nih.gov/articles/PMC10140340/>

Mouse ligature model; Substance P and receptor mechanism. CGRP presence is contextual; its effects require separate model specific assessment.

S07 Proteomic Analysis of a Noninvasive Human Model of Acute Inflammation and Its Resolution The Twenty one Day Gingivitis Model

2010 primary study

<https://pubs.acs.org/doi/10.1021/pr100446f>

Human experimental gingivitis; GCF amount and proteomic changes. Gingivitis is not attachment destructive periodontitis.

S08 Gingival crevicular fluid and saliva stress hormone levels in patients with chronic and aggressive periodontitis

2016 primary study

<https://pubmed.ncbi.nlm.nih.gov/27513682/>

Human cortisol and DHEA measurement; cross sectional association is not proof of causal direction.

S09 Impact of Chronic Periodontitis on Levels of Glucoregulatory Biomarkers in Gingival Crevicular Fluid of Adults with and without Type 2 Diabetes

2015 primary study

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0127660>

Human GCF multiplex panel; ten named glucoregulatory analytes. Record assay specificity and detection separately from functional activity.

S10 Non invasive monitoring of gingival crevicular fluid for estimation of blood glucose level

2004 primary study

<https://pubmed.ncbi.nlm.nih.gov/15191076/>

Human GCF glucose measurement; research record rather than a recommendation for glucose monitoring.

S11 Urea content of gingival crevicular fluid and its relation to periodontal diseases in humans

Primary study PMID 4272018

<https://pubmed.ncbi.nlm.nih.gov/4272018/>

Human GCF urea study. Full methodological reassessment is required for quantitative reuse.

S12 Bacteremia associated with toothbrushing and dental extraction

Lockhart et al 2008

<https://pubmed.ncbi.nlm.nih.gov/18541739/>

Human exposure and bloodstream sampling; transient episodes differ from persistent systemic infection.

S13 Low abundance biofilm species orchestrates inflammatory periodontal disease through the commensal microbiota and complement

Hajishengallis et al 2011

<https://pubmed.ncbi.nlm.nih.gov/22036469/>

Mouse mechanism; a low abundance organism can disproportionately change community and host response. Does not validate every proposed ecological ripple.

S14 Analysis of metabolic profiles of generalized aggressive periodontitis

2018 primary study

<https://pubmed.ncbi.nlm.nih.gov/29974463/>

Human serum and GCF metabolomics. Named GCF metabolites are listed; relative abundance and chemical identity require attention to methods.

S15 A study on sex hormones in gingival crevicular fluid and black pigmented bacteria in subgingival plaque of pregnant women

1995 primary study

<https://pubmed.ncbi.nlm.nih.gov/7602664/>

Human pregnancy and GCF hormones; species reproductive patterns cannot be assumed equivalent.

S16 Gingival inflammation and interleukin 1 beta and tumor necrosis factor alpha levels in gingival crevicular fluid during the menstrual cycle

Primary study PMID 19961381

<https://pubmed.ncbi.nlm.nih.gov/19961381/>

Human longitudinal GCF cytokine measurement through cycle phases.

S17 Effects of menstrual cycle on periodontal health and gingival crevicular fluid markers

2010 primary study

<https://pubmed.ncbi.nlm.nih.gov/20218781/>

Human GCF IL6 PGE2 tPA PAI2 measurements; hormones measured in saliva are not automatically GCF hormones.

S18 Identification of the osteoprotegerin receptor activator of nuclear factor kappa B ligand system in gingival crevicular fluid and tissue of patients with chronic periodontitis

Primary study PMID 16827732

<https://pubmed.ncbi.nlm.nih.gov/16827732/>

Human GCF and gingival tissue RANKL OPG study.

S19 Accuracy of Gingival Crevicular Fluid Biomarkers of MMP8 TIMP1 RANK RANKL and OPG in Differentiating Symptomatic and Asymptomatic Apical Periodontitis

2024 primary study

<https://pubmed.ncbi.nlm.nih.gov/39272657/>

Human apical periodontitis context. Supports GCF measurement of named analytes; does not establish marginal periodontal specificity.

S20 Expanded Human Oral Microbiome Database

eHOMD live curated resource

<https://homd.org/>

Human aerodigestive taxa and genomic resources; not a mammal wide inventory and not proof every taxon occurs at every gum site.

S21 Species level characterization of saliva and dental plaque microbiota in dogs

2024 primary canine study

<https://academic.oup.com/femsec/article/100/6/fiae082/7680587>

Canine oral sequencing in health gingival inflammation and periodontitis; supports species distinctions and conditional colonisation.

S22 Microbial and metabolomic analysis of gingival crevicular fluid in general chronic periodontitis patients

Pei et al 2020

<https://pubmed.ncbi.nlm.nih.gov/32547651/>

Human combined microbiome and metabolome study. Predicted microbial pathways and measured metabolites are distinct evidence.

S23 A qualitative and quantitative analysis of the human gingival crevicular fluid proteome and metaproteome

Xiao et al 2021

<https://pubmed.ncbi.nlm.nih.gov/34464030/>

Existing molecular inventory to link and expand; protein identification does not alone establish activity or a causal role.

Version and update history

9 October 2026 - Version 0.1. Initial working inventory of 276 entries across 12 categories, with occurrence codes, research markers and supporting references.

13 October 2026 - Version 0.2. Added the public introduction and contribution route; clarified the source labels and provisional evidence status; replaced preparation notes with this update history. All 276 entry IDs and table records are retained.

Working draft version 0.2 · Updated 13 October 2026 · 276 stable row IDs · 87 entries linked to supporting sources · 189 entries awaiting precise citation audit · 59 focused measurement flags · 151 proposed research flags. [Corrections and contributions](#).