

PAMGO (Plant-Associated Microbe
Gene Ontology) proposal to the
Gene Ontology Consortium

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The PAMGO proposal :

- 2) Collapse the two currently existing GO higher order terms (“host-pathogen interaction’ and “pathogenesis” into one = “interaction with host organism”
- 3) Create new, broad terms suitable for annotating genes of cellular pathogens and symbionts (have many early steps in common) of both plants and animals
- 4) Accommodate other currently existing GO terms when possible

biological process (GO:0008150)

---% physiological process (GO:0007582)

-----% interaction with other organism

-----% interaction with non-host organism

-----% **interaction with host organism****

**Definition = any interaction between an organism, usually a parasite or symbiont, and another organism from which it may obtain nourishment, protection, and/or a means of dispersal

biological process – physiological process (GO:0007582)

---% interaction with other organism

-----% interaction with non-host organism

-----% competition with nonhost organism

-----% killing of non-host cells

-----% biofilm formation (GO:0042710) (*higher order?*)

-----% **interaction with host organism**

interaction with other organism -- the processes by which organisms act on, affect, or influence each other

% interaction with non-host organism -- any process in which an organism interacts with another organism that does not act as its host

%% competition with non-host organism -- any process by which one community member gains an advantage in growth or survival over another community member

%%% killing of non-host cells -- any process in an organism that results in the death of another, non-host organism or its cells

%% biofilm formation (GO:0042710)

% interaction with host organism -- any interaction between an organism, usually a parasite or symbiont, and another organism from which it may obtain nourishment, protection, and/or a means of dispersal

% interaction with non-host organism

%% competition with non-host organism

%%% killing of non-host cells

%% **biofilm formation** (GO:0042710) = A process whereby microorganisms irreversibly attach to and grow on a surface and produce extracellular polymers that facilitate attachment and matrix formation, resulting in an alteration in the phenotype of the organisms with respect to growth rate and gene transcription)

Newly developed terms in **bold**:

% interaction with host organism

---% **recognition of host**

---% **adhesion to host**

-----% cytoadherence to microvasculature (GO:0020035) –
(*moved from child of “host-pathogen interaction”*)

---% virus-host interaction (GO:0019048) (*also moved*)

-----% viral host cell process manipulation (GO:0019054)

-----% viral host defense evasion (GO:0019049)

-----% viral induction of host immune response (GO:0046730)

---% **growth on or near host surface**

%% recognition of host – the specific processes that allow an organism to detect the presence of a host via physical or chemical signals

%% adhesion to host – the attachment of an organism to its host via adhesion molecules, general stickiness, etc., either directly or indirectly

%% growth on or near host surface – an increase in size or number of an organism on or near the exterior of its host

---% **entry into host**

-----% **entry into host through natural portals**

-----% **entry into host through host barriers**

-----% cell invasion (GO:0030260)

-----% viral entry (GO:0046718)

---% **evasion or suppression of host defenses** [*more broad*]

-----% evasion of host defense response (GO:0030682)
(*moved from “host-pathogen interaction”*)

-----% evasion of host immune response (GO:0020012)

-----% viral host defense evasion (GO:0019049)

%% **entry into host** -- penetration by an organism into the body, cells, or tissues of the host (Q: *“invasion of host” a synonym?*)

%%% **entry into host through natural portals** -- penetration by an organism to the inside of a host via naturally occurring openings in the host

%%% **entry into host through host barriers** -- penetration by an organism to the inside of a host via active breaching of physical barriers

%%% **cell invasion** (GO:0030260)

(continued)

%%% **cell invasion** (GO:0030260) = invasion of a host cell by another cell (microorganism) or virus

%%%% **viral entry** (GO:0046718) = the process by which a virion enters a host cell, including virion attachment and penetration.

[NOTE: We suggest that this term be made a child of “cell invasion” in addition to its current place as a child of “initiation of viral infection”]

*NOTE: We propose that currently existing GO term, GO:0001404 = **invasive growth** (currently a child of “pathogenesis”), should be deleted. That term is used differently for plant and animal pathogens, and there are currently no gene products annotated to this term in GO*

%% evasion or suppression of host defenses --
any process by which an organism avoids,
minimizes, or suppresses the effects of a host
defense(s), which can be either basal or induced [*a
more broad term, as all defenses are not
“responses”*]

%%% evasion of host defense response
(GO:0030682) = any process by which a pathogen
evades or minimizes the effects of a defense
response mounted against it by its host (*currently a
child of “host-pathogen interactions”*)

%%%% evasion of host immune response
(GO:0020012)

%%%% viral host defense evasion (GO:0019049)
(*error here?? Move out one level to broaden beyond
“response”???*)

---% induction of host defense response

-----% viral induction of host immune response (GO:0046730)

---% translocation of molecules into host

-----% **translocation of DNA into host**

-----% **translocation of protein into host**

-----% type III protein secretion system (GO:0030254)

-----% type IV protein secretion system (GO:0030255) –
(newly added to PAMGO terms)

---% movement within host

-----% **migration within host**

-----% viral spread within host (GO:0046739)

%% induction of host defense response -- the triggering by an organism of reactions in a host that can act to protect the host cell(s) or host organism

%%% viral induction of host immune response
(GO:0046730)

%% translocation of molecules into host -- the directed movement of a molecule(s) produced by an organism to a location inside the host

%%%% translocation of DNA into host

%%%% translocation of protein into host

%%%% type III protein secretion system (GO:0030254)

%%%% type IV protein secretion system (GO:0030255) –

(an addition to current proposal)

%% **movement within host** -- the process by which an organism or its progeny spreads from one location to another within a host

%% **migration within host** -- the directional movement of an organism from one place to another within a host

%% **viral spread within host** (GO:0046739)

---% **acquisition of nutrients from host**

---% **modification of host morphology or physiology**

-----% viral host cell process manipulation (GO:0019054)

-----% viral transformation (GO:0019087)

-----% viral immortalization (GO:0019088)

-----% **disruption of host cells**

-----% **killing of host cells**

-----% hemolysis (GO:0019836)

-----% necrosis (GO:0008220) ??

-----% **induction in host of a tumor, nodule, or growth**

%% **acquisition of nutrients from host** -- the production of structures and/or molecules in an organism that are required for the acquisition and/or utilization of nutrients obtained from its host

%% **modification of host morphology or physiology** -- the process of effecting a change in the structure or function of a host by means of molecules produced by an associated organism

%%% viral host cell process manipulation (GO:0019054)

%%% viral transformation (GO:0019087)

%%%% viral immortalization (GO:0019088)

%% **modification of host morphology or physiology** (continued)

%%% **disruption of host cells** -- any process in an organism that results in damage to the structure or function of the cell

%%%% **killing of host cells** -- any process in an organism that results in the death of its host or cells of its host

%%%%% **hemolysis** (GO:0019836) – *currently is child of “pathogenesis” – suggest it be moved here*

%%%%% **necrosis** (GO:0008220) = the processes that cause necrosis, the death of tissues, in another organism -- *currently is child of “pathogenesis” -- has 13 annotations – be obsoleted?? Made synonym??*

%% modification of host morphology or physiology
(continued)

%%% induction in host of a tumor, nodule, or growth
--- the process by which an associated organism causes the formation of an abnormal mass of cells in the host

%%%% induction in host of a tumor, nodule, or growth containing transformed cells -- the process by which an associated organism causes the formation in a host of an abnormal growth whose cells have been transformed and continue to exist in the absence of the inducing organism. *[NOTE: We suggest this should replace the current GO term “host cell immortalization” (GO:0020021 = the modification of a host cell into an immortal cell line as a consequence of infection), which currently has no genes annotated to it.]*

%% modification of host morphology or physiology
(continued)

%%% induction in host of a tumor, nodule, or growth

%%%% induction in host of a tumor, nodule, or growth
containing transformed cells

%%%% **induction in host of a tumor, nodule, or
growth not containing transformed cells** – the process
by which an associated organism causes the formation in
a host of an abnormal growth whose cell size or number
has increased but which is not sustained in the absence of
the inducing organism

**---% dissemination or transmission of an organism
from a host**

**-----% dissemination or transmission of an organism
from a host by a vector**

-----% viral transmission (GO:0019089)

%% dissemination or transmission of an organism from a host -- the movement of an organism from a host to another host or another place in the environment

%%% dissemination or transmission of an organism from a host by a vector -- the movement of an organism from one host to another (or another place in the environment) by means of a third organism (usually an insect or other animal)

%%% viral transmission (GO:0019089) = the transfer of virions in order to create new infection)

Possible integration of host terms – all integrated together, or separate DAGs from pathogen/symbiont terms?

interaction with other organism

%interaction with non-host organism

%interaction with host organism

%%**detection *by host* of pest/pathogen/parasite**

(GO:0009596)

(some changes in terms may be necessary for clarity)

biological process

%physiological process

%%interaction with other organism

%%**cell killing** (*, other organism?*) -- any process in an organism that results in the death of another organism or its cells

%%**killing of non-host cells** -- any process in an organism that results in the death of another, non-host organism or its cells

%%**killing of host cells** -- any process in an organism that results in the death of its host or cells of its host