~~ClaimsWhat is claimed is:~~CLAIMS

1. A ventilation system return register that is mountable in a room from with air will flow through the return register, comprising:

a housing that defines an internal volume through which air can flow;

a transition collar configured to attach to a duct of the ventilation system;

an electrical junction box configured to receive an electrical connection;

a disinfecting light source electrically connected to the electrical junction box and configured to emit a radiation in a range that destroys microbial contaminants;

a reflective surface facing the disinfecting light and defining a disinfecting pathway through which air passes when the ventilation system is operating; and

an intake plate covering the disinfecting light source and preventing light emitted from the disinfecting light source to shine into the room when the intake plate is in a closed position, wherein

a return air flow path is defined from the intake plate through the disinfecting pathway to the internal volume of the housing and through the transition collar into the ventilation system duct.

2. The ventilation system return register according to claim 1, further comprising:

a filter bracket configured to hold at least one filter between the intake plate and the transition ring.

3. The ventilation system return register according to any of claims 1-2, further comprising:

a filter held by the filter bracket, wherein

at least one surface of the filter is exposed to radiation emitted by the disinfecting light.

4. The ventilation system return register according to claim 1, further comprising:

a pivot bracket rotatably mounted to the housing such that the pivot bracket can pivot about an axle, wherein

the intake plate is attached to the pivot bracket at one end of the intake plate.

5. The ventilation system return register according to any of claims 1-4, further comprising:

at least one latch on the housing configured to ~~old~~hold the intake plate in the closed position when the latch is closed, and to permit the intake plate to rotate to an opened position when the latch is opened.

6. The ventilation system return register according to any of claims 1-5, wherein

the intake plate is configured to move between the closed position and an opened position,

when the intake plate is in the closed position, radiation from the disinfecting light does not emit outside of the return register into space from which the return register is configured to receive return air, and

when the intake plate is in the opened position, radiation from the disinfecting light radiates into the space from which the return register is configured to receive return air.

7. The ventilation system return register according to any of claims 1-6, further comprising:

a powered mechanism that that engages the pivot bracket to rotate the pivot bracket.

8. The ventilation system return register according to any of claims 1-7, wherein

the powered mechanism is electrically connected to the electrical junction box to receive electricity and control signals,

the powered mechanism is configured to move the intake plate between an opened position and the closed position in response to the control signals.

9. The ventilation system return register according to any of claims 1-8, further comprising:

a controller electrically connected through the electrical junction box to the powered mechanism and configured to output control signals that command the powered mechanism to move between the opened and closed position;

one or more sensors configured to detect conditions in the space from which the return register is configured to receive return air and to output one or more sensor signals;

a user interface configured to receive input commands from a user, wherein

the controller is configured to receive at least the one or more sensor signals and the input commands and to command the powered mechanism based on the one or more sensor signals and the input commands.

10. The ventilation system return register according to any of claims 1-9, wherein

the controller is further configured to receive a first sensor signal that indicates an airflow quantity through the return register,

the controller is further configured to receive a sensor signal that indicates whether a door into the room is closed,

the controller is further configured to determine whether the airflow quantity exceeds a first threshold, and

the controller is further configured to turn on the disinfecting light source when it determines that the airflow quantity exceeds the first threshold and the door into the room is closed, and to turn off the disinfecting light source off otherwise.

11. The ventilation system return register according to any of claims 1-10, wherein the sensors include one or more of:

a proximity sensor, an infrared sensor, a magnetic sensor, a reed switch, an acoustic sensor, a temperature sensor, a pressure sensor, an airflow velocity sensor, an airflow volume sensor, a capacitance sensor, and an optical sensor.

12. The ventilation system return register according to any of claims 1-11, wherein

the light source includes an ultra-violet (UV) light that is configured to emit light in a frequency range of 240-280 nm.

13. The ventilation system return register according to any of claims 1-12, further comprising:

a fan configured to generate a flow of air through the disinfecting pathway and into the transition collar; and

a drive mechanism that powers the fan.

14. The ventilation system return register according to any of claims 1-13, wherein

the controller is configured to output a control signal to the drive mechanism and thereby control a speed of the fan, and

the controller is configured to control the speed of the fan in response to a pressure signal indicating a pressure in the ventilation system duct.

15. The ventilation system return register according to any of claims 1-14, wherein

the transition collar is fluidly connected to the ventilation system duct,

the ventilation system duct is configured to convey return air from the return register to an air handler of a ventilation system that includes a ventilation system controller,

the ventilation system controller is operatively connected to the controller of the return register and is configured to receive and transmit signals from and to the controller of the return register.

16. A ventilation system for an enclosed space, the ventilation system comprising:

an air treatment system that receives air at an intake plenum, treats the air, and outputs treated air at an outlet plenum;

at least one supply duct connected to the outlet plenum and conveying the treated air toward the enclosed space;

at least one return duct connected to the intake plenum and conveying return air from the enclosed space to the intake plenum;

one or more sensors configured to detect conditions in at least the enclosed space, the supply duct, or the return duct;

a controller configured to receive a signal from the one or more sensors;

a return register mounted in the enclosed space, the return register including

a housing that defines an internal volume through which return air can flow;

a transition collar attached to the return duct;

an electrical junction box configured to receive an electrical connection;

a disinfecting light source electrically connected to the electrical junction box and configured to emit a radiation in a range that destroys microbial contaminants;

a reflective surface facing the disinfecting light and defining a disinfecting pathway through which air passes when the ventilation system is operating; and

an intake plate covering the disinfecting light source and preventing light emitted from the disinfecting light source to shine into the enclosed space when the intake plate is in a closed position, wherein

a return air flow path is defined from the intake plate through the disinfecting pathway to the internal volume of the housing and through the transition collar into the return duct.

17. The ventilation system according to claim 16, wherein

the controller is configured to turn on and off the disinfecting light source when it determines that an airflow through the return duct is above a predetermined threshold and a door into the enclosed space is closed.

18. The ventilation system according to claim 16, wherein

the controller is configured to turn on and off a fan in the return register.

19. A light fixture mountable on an internal surface of an enclosed space, the light fixture comprising:

a housing that includes a disinfecting plenum and an intake plenum;

the intake plenum having an air inlet and a fan and fluidly connected to the disinfecting plenum;

the fan configured to draw from the enclosed space through the air inlet into the intake plenum and through the disinfecting plenum;

the disinfecting plenum being defined by a portion of the housing at one side of the disinfecting plenum and by at least one rotating plate on an opposite side of the disinfecting plenum, the disinfecting plenum extending from the intake plenum to an air outlet;

the at least one rotating plate rotatably mounted within the housing and configured to rotate about a rotation axis, the at least one rotating plate having a first side and a second side opposed to the first side;

a disinfecting light source mounted on the first side of the rotating plate; and

a visible light source mounted on the second side of the rotating plate.

20. The light fixture according to claim 19, further comprising:

a light tube holder that extends through the rotating plate and holds the disinfecting light source on the first side and holds the visible light source on the second side.

~~21. The light fixture according to claim 19, further comprising:~~

~~a controller configured to control the fan, the disinfecting light source, and the visible light source; and~~

~~one or more sensors configured to sense conditions in the enclosed space and to output sensor signals to the controller.~~

~~22. The light fixture according to claim 21, further comprising:~~

~~a user interface configured to receive user input and to output a signal to the controller.~~

~~23. The light fixture according to claim 21, wherein~~

~~the controller is configured to control rotation of the rotating plate between an occupied mode and an unoccupied mode,~~

~~in the occupied mode the disinfecting light source is enclosed within the disinfecting plenum and radiation from the disinfecting light source does not reach the enclosed space while the visible light source is positioned to emit visible light into the enclosed space, and~~

in the unoccupied mode the rotating plate is rotated until the disinfecting light source is exposed to the enclosed space and can emit radiation directly into the enclosed space in which the light fixture is mounted while the visible light source is positioned in the disinfecting plenum.

24. The light fixture according to claim 23, wherein

the controller is configured to turn on the fan in the occupied mode and to turn off the fan in the unoccupied mode.

25. The light fixture according to claim 24, wherein

the controller is further configured to turn on and off the visible light source based on a user input and a signal from a proximity sensor when the light fixture is in the occupied mode,

the controller is further configured to turn on the disinfecting light source when light fixture is in the unoccupied mode, and

the controller is further configured to turn off the disinfecting light source when a signal from the one or more sensors indicates that the enclosed space is occupied.

26. The light fixture according to any of claims 19-25, wherein the one or more sensors include a proximity sensor, an infrared sensor, a magnetic sensor, a reed switch, an acoustic sensor, a temperature sensor, a pressure sensor, an airflow velocity sensor, an airflow volume sensor, a capacitance sensor, and an optical sensor.

27. The light fixture according to any of claims 19-26, wherein

the internal surface is a ceiling of a room, a wall of a room, or a corner where the ceiling and the wall meet.

28. An illumination and ventilation system for an enclosed space, comprising:

a light fixture mounted on an internal surface of an enclosed space, the light fixture including

a housing that includes a disinfecting plenum and an intake plenum;

the intake plenum having an air inlet and a fan and fluidly connected to the disinfecting plenum;

the fan configured to draw from the enclosed space through the air inlet into the intake plenum and through the disinfecting plenum;

the disinfecting plenum being defined by a portion of the housing at one side of the disinfecting plenum and by at least one rotating plate on an opposite side of the disinfecting plenum, the disinfecting plenum extending from the intake plenum to an air outlet;

the at least one rotating plate rotatably mounted within the housing and configured to rotate about a rotation axis, the at least one rotating plate having a first side and a second side opposed to the first side;

a disinfecting light source mounted on the first side of the rotating plate; and

a visible light source mounted on the second side of the rotating plate;

a controller configured to control the fan, the disinfecting light source, and the visible light source; and

one or more sensors configured to sense conditions in the enclosed space and to output sensor signals to the controller, wherein

the internal surface is a ceiling of a room, a wall of a room, or a corner where the ceiling and the wall meet,

the controller is configured to control rotation of the rotating plate between an occupied mode and an unoccupied mode,

in the occupied mode the disinfecting light source is enclosed within the disinfecting plenum and radiation from the disinfecting light source does not reach the enclosed space while the visible light source is positioned to emit visible light into the enclosed space, and

in the unoccupied mode the rotating plate is rotated until the disinfecting light source is exposed to the enclosed space and can emit radiation directly into the enclosed space in which the light fixture is mounted while the visible light source is positioned in the disinfecting plenum.

29. The illumination and ventilation system according to claim 28, wherein

the controller is further configured to turn on and off the visible light source based on a user input and a signal from a proximity sensor when the light fixture is in the occupied mode,

the controller is further configured to turn on the disinfecting light source when light fixture is in the unoccupied mode, and

the controller is further configured to turn off the disinfecting light source when a signal from the one or more sensors indicates that the enclosed space is occupied.

30. The illumination and ventilation system according to claim 28, further comprising:

a ventilation system including

an air treatment system that receives air at an intake plenum, treats the air, and outputs treated air at an outlet plenum;

at least one supply duct connected to the outlet plenum and conveying the treated air toward the enclosed space;

at least one return duct connected to the intake plenum and conveying return air from the enclosed space to the intake plenum;

a return register mounted in the enclosed space, the return register including

a housing that defines an internal volume through which return air can flow;

a transition collar attached to the return duct;

an electrical junction box configured to receive an electrical connection;

a disinfecting light source electrically connected to the electrical junction box and configured to emit a radiation in a range that destroys microbial contaminants;

a reflective surface facing the disinfecting light and defining a disinfecting pathway through which air passes when the ventilation system is operating; and

an intake plate covering the disinfecting light source and preventing light emitted from the disinfecting light source to shine into the room when the intake plate is in a closed position, wherein

a return air flow path is defined from the intake plate through the disinfecting pathway to the internal volume of the housing and through the transition collar into the return duct.

31. A method of retrofitting a sanitizing return grille in a ventilation system, the method comprising:

providing a sanitizing return grille;

measuring a first air flow through an existing return grille of the ventilation system when the ventilation system is in a normal operating mode;

removing the existing return grille;

installing the sanitizing return grille in place of the removed existing return grille;

measuring a second air flow through the installed sanitizing return grille when the ventilation system is in the normal operating mode;

determining a difference between the first air flow and the second air flow;

configuring a fan of the sanitizing return grille to operate at a compensation speed that compensates for the difference between the first air flow and the second air flow, such that when the ventilation system operates in the normal mode, the air flow through the sanitizing return grille is at the first air flow.

32. The method of claim 31, wherein the sanitizing return grille is the ventilation system return register according to any of claims 1-15.

33. A method of disinfecting a surface in a room, the method comprising:

installing a light fixture according to any of claims 19-27 in the room;

receiving input from one or more sensors in the room;

determining that the room is unoccupied based on the input from the one or more sensors in the room;

operating the light fixture in the unoccupied mode;

continuously monitoring the input from the sensors to determine whether the room remains unoccupied; and

turning off the disinfecting light source when it is determined that the room is not unoccupied.

34. A method of reducing airborne pathogens exhaled by human occupants of a room from spreading through a ventilation system, the method comprising:

installing a ventilation system return register according to any of claims 1-15; and

operating the ventilation system return register when the ventilation system draws return air from the room into a return duct.

35. The method according to claim 34, further comprising:

installing a light fixture according to any of claims 19-27;

operating the light fixture in occupied mode when human occupants are present in the room; and

operating the light fixture in unoccupied mode when no human occupants are present in the room.

36. A method, comprising:

providing a dual-mode fixture that is configured to generate a first radiation with germicidal properties and a second radiation with illumination properties;

at a first time, generating the first radiation with the germicidal properties in the dual-mode fixture;

flowing air through the dual-mode fixture and exposing the air to the first radiation with the germicidal properties during the flowing, while substantially preventing the first radiation to irradiate surfaces outside of the dual-mode fixture; and

at the first time, generating the second radiation with the illumination properties and irradiating surfaces outside of the dual-mode fixture with the second radiation.

37. The method according to claim 36, further comprising:

at a second time that is different from the first time, changing a physical configuration of the dual-mode fixture to permit the first radiation with the germicidal properties to radiate outside of the dual-mode fixture and to permit the first radiation to irradiate surfaces outside of the dual-mode fixture.

38. The method according to claim 37, further comprising:

at the second time, discontinuing the generation of the second radiation with the illumination properties.

39. The method according to any of claims 36-38, wherein

the first radiation has a wavelength in an ultraviolet frequency range, and

the second radiation includes wavelengths in a visible light spectrum.

40. The method according to claim 39, wherein

the first radiation has wavelengths in a range of 240-280 nm.

41. The method according to claim 38, further comprising:

verifying absence of human occupants in a vicinity of the dual-mode fixture before the second time.

42. The method according to claim 38, further comprising:

at a third time, distinct from the second time, detecting presence of a human occupant in a vicinity of the dual-mode fixture; and

discontinuing the generating of the first radiation in response to the detecting of the presence.

43. The method according to claim 42, further comprising:

at a fourth time, distinct from the third time, verifying absence of human occupants in a vicinity of the dual-mode fixture; and

recommencing the generating of the first radiation in response to the verifying the absence.

~~44. The method according to claim 43, further comprising:~~

~~at a fifth time, distinct from the fourth time, changing the physical configuration of the dual-mode fixture to substantially prevent the first radiation with the germicidal properties to radiate outside of the dual-mode fixture and recommencing the generation of the second radiation with the illumination properties.~~

~~45. The method according to claim 44, wherein~~

~~the fifth time is an absolute time of time.~~

~~46. The method according to claim 45, further comprising:~~

~~storing the fifth time in a controller memory.~~