The **solubility pump** is the physical dissolution equilibrium of CO_2 between the ocean and the atmosphere (Baltar *et al.*, 2021a). As CO_2 is nowadays in excess in the atmosphere because of human activities, the solubility pump is a net sink of carbon from the atmosphere to the ocean, absorbing annually ~ 25 % of atmospheric human CO_2 emissions (Watson *et al.*, 2020).

The **carbonate pump** is the export of Particulate Inorganic Carbon (PIC) from the top layers of the ocean to the sea bottom *via* the sinking of shells produced by calcifying planktonic organisms, such as coccolithophores or foraminifera (Volk and Hoffert, 1985). Whether this mechanism stores carbon or releases it to the atmosphere is not well constrained, as the calcification reaction releases CO_2 that is then involved in numerous retroactions (Legendre *et al.*, 2015).

The last two mechanisms are tightly linked. They either start from the reduction of Inorganic Carbon (IC) to Organic Carbon (OC) through photosynthesis by marine primary producers, or from terrestrial inputs of OC from land to the ocean (in coastal areas, not represented on the figure). This OC is then passed on successive levels of the food web, consumer after consumer (*e.g.*, phytoplankton to copepods to fish) (Jiao *et al.*, 2010). Some of this OC is used by micro- or macro-organisms to build their structures or to obtain energy out of it for their functioning, while some is lost in the environment (*e.g.*, through exudates, death) in the form of POC or DOC. This OC eventually follows one of the three following paths:

- The OC is fully remineralised, that is, oxidised back to CO_2 through respiration. It is then available for exchanges through the **solubility** and/or the **carbonate pump**.

- The POC sinks towards the sea bottom under the effect of gravity in the form of dead bodies or fecal pellets (Ducklow *et al.*, 2001, Legendre *et al.*, 2015). It may eventually be buried in sediments, and remain stored there for long periods of time, up to millions of years (Ducklow *et al.*, 2001, Herndl and Reinthaler, 2013, Legendre *et al.*, 2015). This mechanism is called the **biological pump**. POC is the main way by which OC produced by phytoplankton is exported from the surface to the deep ocean and eventually sediments (Kharbush *et al.*, 2020).
  DOC is mainly accessible to Bacteria and Archaea. Bacteria and Archaea that processed this DOC may be consumed by zooplankton in a process called the microbial loop (hence reintroducing carbon to higher trophic levels), or killed by viruses in a process called the viral shunt (hence releasing their carbon back to the DOC pool).

- The DOC is not fully oxidised by Bacteria and Archaea nor passed to the microbial loop, and is rather modified into reaction by-products that are not easily usable by other organisms (Jiao et *al.*, 2010). These compounds are termed refractory DOC (RDOC) (Jiao *et al.*, 2010). As this RDOC is not easy to use, it tends to accumulate in the DOC pool, and can remain stored in this pool for long periods of time (*i.e.*, 20 to 40,000 years) (Legendre *et al.*, 2015). This mechanism is called the **microbial pump**.

Figure adapted from Jiao *et al.*, 2010.