

S1 Appendix. Clavis JSON-schema

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "title": "Clavis identification key schema",
  "description": "Clavis-compliant keys contain knowledge that may be
used to distinguish taxa from each other.",
  "type": "object",
  "required": [
    "$schema",
    "title",
    "language",
    "license",
    "creator",
    "lastModified",
    "identifier",
    "taxa",
    "characters",
    "statements"
  ],
  "properties": {
    "$schema": {
      "description": "The schema url of (this) schema defining the
format of the key.",
      "$ref": "#/definitions/url"
    },
    "title": {
      "description": "The name of the key",
      "comment": "Accepts array for multilingual support.",
      "$ref": "#/definitions/localizedString",
      "examples": [
        "Birds of Norway"
      ]
    },
    "media": {
      "description": "The logo/illustration image of the key.",
      "$ref": "#/definitions/mediaID"
    },
    "description": {
      "description": "Short description of the key (valid markdown).",
      "comment": "Accepts array for multilingual support.",
      "$ref": "#/definitions/localizedString",
      "contentMediaType": "text/markdown"
    },
    "descriptionDetails": {
      "description": "Extended description of the key that supplements
the description (valid markdown).",
```

```

        "comment": "Accepts array for multilingual support.",
        "$ref": "#/definitions/localizedString",
        "contentMediaType": "text/markdown"
    },
    "descriptionUrl": {
        "description": "Hyperlink to more information on the key (valid
url).",
        "comment": "Accepts array for multilingual support.",
        "$ref": "#/definitions/localizedUrl"
    },
    "audience": {
        "description": "Description of the intended audience for the
key.",
        "comment": "Accepts array for multilingual support.",
        "$ref": "#/definitions/localizedString",
        "examples": [
            "Undergraduate students and up."
        ]
    },
    "source": {
        "description": "Source of the key.",
        "comment": "Accepts array for multilingual support.",
        "$ref": "#/definitions/localizedString",
        "examples": [
            "Koch, Wouter (2019). Birds of Norway. ISBN 1234567890"
        ]
    },
    "sourceUrl": {
        "description": "Hyperlink to the source of the key (valid url).",
        "comment": "Accepts array for multilingual support.",
        "$ref": "#/definitions/localizedUrl",
        "examples": [
            "https://doi.org/10.1126/science.1251554"
        ]
    },
    "geography": {
        "description": "The region for which the key is valid (e.g. covers
all subtaxa), represented as a geography object.",
        "$ref": "#/definitions/geography"
    },
    "primaryContact": {
        "description": "The organization- or person-id that is the main
contact point for the key.",
        "oneOf": [
            {
                "$ref": "#/definitions/personID"
            },
            {
                "$ref": "#/definitions/organizationID"
            }
        ]
    },
    },

```

```

"creator": {
  "description": "The id(s) of the creator(s) of the key",
  "oneOf": [
    {
      "$ref": "#/definitions/personID"
    },
    {
      "type": "array",
      "items": {
        "$ref": "#/definitions/personID"
      }
    }
  ]
},
"contributor": {
  "description": "The id(s) of the contributor(s) of the key",
  "oneOf": [
    {
      "$ref": "#/definitions/personID"
    },
    {
      "type": "array",
      "items": {
        "$ref": "#/definitions/personID"
      }
    }
  ]
},
"publisher": {
  "description": "The id(s) of the publishing institutions of the
key.",
  "oneOf": [
    {
      "$ref": "#/definitions/organizationID"
    },
    {
      "type": "array",
      "items": {
        "$ref": "#/definitions/organizationID"
      }
    }
  ]
},
"license": {
  "description": "The url to the license under which the key
falls.",
  "$ref": "#/definitions/url",
  "examples": [
    "https://creativecommons.org/licenses/by/4.0/"
  ]
},
"language": {

```

```

        "description": "The ISO 639-1 code(s) of the key language(s).",
        "comment": "String for a single language, array of strings for
multilingual support. If used as an array, be sure to use the
localizedString and localizedUrl as arrays too.",
        "oneOf": [
            {
                "type": "string",
                "pattern": "^[a-z]{2}$"
            },
            {
                "type": "array",
                "items": {
                    "type": "string",
                    "pattern": "^[a-z]{2}$"
                }
            }
        ],
        "examples": [
            "en",
            "nb",
            [
                "en",
                "nb"
            ]
        ]
    },
    "created": {
        "description": "The moment the key was made or first published, as
'YYYY-MM-DD hh:mm:ss'.",
        "type": "string",
        "pattern": "^20\\d\\d-(0[1-9]|1[0-2])-(0[12]\\d|3[01])
([01]\\d|2[0-3]):([0-5]\\d):([0-5]\\d)$",
        "examples": [
            "2019-05-21 22:51:55"
        ]
    },
    "lastModified": {
        "description": "The most recent moment the key was modified, as
'YYYY-MM-DD hh:mm:ss'.",
        "type": "string",
        "pattern": "^20\\d\\d-(0[1-9]|1[0-2])-(0[12]\\d|3[01])
([01]\\d|2[0-3]):([0-5]\\d):([0-5]\\d)$",
        "examples": [
            "2019-05-21 22:51:55"
        ]
    },
    "identifier": {
        "description": "The GUID of this key (persistent regardless of
version).",
        "type": "string"
    },
    "url": {

```

```

        "description": "The url of where the key lives (to check for newer
versions).",
        "$ref": "#/definitions/url"
    },
    "externalServices": {
        "description": "Services used by the key for lookups of images,
taxa, etc.",
        "type": "array",
        "items": {
            "$ref": "#/definitions/externalService"
        }
    },
    "userRequirements": {
        "description": "Requirements to the users of the various
characters, so that the user can be warned, helped, etc.",
        "type": "array",
        "items": {
            "$ref": "#/definitions/userRequirement"
        }
    },
    "taxa": {
        "description": "Taxa (e.g. species) the key can resolve to. Do not
have to be exclusively taxonomic units.",
        "comment": "Taxa to which the key can resolve (either the taxa
directly or their children).",
        "type": "array",
        "items": {
            "$ref": "#/definitions/taxon"
        }
    },
    "characters": {
        "description": "Characters (questions, e.g. 'Wing color' or
'Number of spots') used to distinguish between two or more taxa.",
        "type": "array",
        "items": {
            "$ref": "#/definitions/character"
        }
    },
    "statements": {
        "description": "Relationships between taxa and character states
(or lack thereof) that define those taxa.",
        "type": "array",
        "items": {
            "$ref": "#/definitions/statement"
        }
    },
    "persons": {
        "description": "Persons that are connected to (parts of) the key,
such as creators.",
        "type": "array",
        "items": {
            "$ref": "#/definitions/person"
        }
    }

```

```

    }
    },
    "organizations": {
      "description": "Organizations that are connected to (parts of) the
key or persons, such as employers and publishers.",
      "type": "array",
      "items": {
        "$ref": "#/definitions/organization"
      }
    },
    "mediaElements": {
      "description": "Media elements that are used in the key.",
      "type": "array",
      "items": {
        "$ref": "#/definitions/localizedMediaElement"
      }
    }
  },
  "additionalProperties": false,
  "definitions": {
    "localizedString": {
      "description": "Language-dependent string or object of strings,
with keys corresponding to the languages supported by the key.",
      "oneOf": [
        {
          "type": "string"
        },
        {
          "type": "object",
          "propertyNames": {
            "pattern": "^[a-z]{2}$"
          },
          "properties": {},
          "additionalProperties": {
            "type": "string"
          }
        }
      ]
    },
    "localizedUrl": {
      "description": "Language-dependent urls or object of urls,
corresponding to the languages supported by the key.",
      "oneOf": [
        {
          "$ref": "#/definitions/url"
        },
        {
          "type": "object",
          "propertyNames": {
            "pattern": "^[a-z]{2}$"
          },
          "properties": {},

```

```

        "additionalProperties": {
            "$ref": "#/definitions/url"
        }
    },
    "localizedMediaElement": {
        "type": "object",
        "description": "Language-dependent media element or object of
media elements, corresponding to the languages supported by the key.",
        "properties": {
            "id": {
                "description": "Internally unique id of the localized media
element.",
                "$ref": "#/definitions/mediaID"
            },
            "mediaElement": {
                "description": "The media element or media elements (one for
each language).",
                "oneOf": [
                    {
                        "$ref": "#/definitions/mediaElement"
                    },
                    {
                        "type": "object",
                        "propertyNames": {
                            "pattern": "^[a-z]{2}$"
                        },
                        "properties": {},
                        "additionalProperties": {
                            "$ref": "#/definitions/mediaElement"
                        }
                    }
                ]
            }
        },
        "additionalProperties": false
    },
    "url": {
        "description": "String formed as a url, or an external
resource.",
        "oneOf": [
            {
                "type": "string",
                "format": "uri"
            },
            {
                "$ref": "#/definitions/externalResource"
            }
        ]
    },
    "taxonID": {

```

```

        "description": "String used as an internal ID for a taxon.
Lowercase alphanumeric and underscores are allowed.",
        "type": "string",
        "pattern": "^taxon:[a-z0-9_]+$"
    },
    "characterID": {
        "description": "String used as an internal ID for a character.
Lowercase alphanumeric and underscores are allowed.",
        "type": "string",
        "pattern": "^character:[a-z0-9_]+$"
    },
    "stateID": {
        "description": "String used as an internal ID for a state.
Lowercase alphanumeric and underscores are allowed.",
        "type": "string",
        "pattern": "^state:[a-z0-9_]+$"
    },
    "personID": {
        "description": "String used as an internal ID for a person.
Lowercase alphanumeric and underscores are allowed.",
        "type": "string",
        "pattern": "^person:[a-z0-9_]+$"
    },
    "organizationID": {
        "description": "String used as an internal ID for an organization.
Lowercase alphanumeric and underscores are allowed.",
        "type": "string",
        "pattern": "^organization:[a-z0-9_]+$"
    },
    "serviceID": {
        "description": "String used as an internal ID for a service.
Lowercase alphanumeric and underscores are allowed.",
        "type": "string",
        "pattern": "^service:[a-z0-9_]+$"
    },
    "statementID": {
        "description": "String used as an internal ID for a statement.
Lowercase alphanumeric and underscores are allowed.",
        "type": "string",
        "pattern": "^statement:[a-z0-9_]+$"
    },
    "userRequirementID": {
        "description": "String used as an internal ID for a user
requirement. Lowercase alphanumeric and underscores are allowed.",
        "type": "string",
        "pattern": "^requirement:[a-z0-9_]+$"
    },
    "mediaID": {
        "description": "String used as an internal ID for a media element.
Lowercase alphanumeric and underscores are allowed.",
        "type": "string",
        "pattern": "^media:[a-z0-9_]+$"
    }

```



```

    },
    "mediaFile": {
      "type": "object",
      "properties": {
        "title": {
          "description": "The title of the media file.",
          "$ref": "#/definitions/localizedString"
        },
        "url": {
          "description": "The reference to the media file (url or
resource).",
          "$ref": "#/definitions/url"
        },
        "file": {
          "description": "The actual media file (base64 or svg) as a
data URI scheme.",
          "oneOf": [
            {
              "type": "string",
              "pattern": "^data:([a-z0-9/]+);base64,([a-zA-Z0-9+/=]+)$"
            },
            {
              "type": "string",
              "pattern": "^data:image/svg\\+xml;utf8,(.*)$"
            }
          ]
        },
        "width": {
          "description": "The number of pixels horizontally (if a bitmap
image or video).",
          "type": "integer"
        },
        "height": {
          "description": "The number of pixels vertically (if a bitmap
image or video).",
          "type": "integer"
        },
        "length": {
          "description": "The length in seconds of an audio or video
file.",
          "type": "integer"
        },
        "placeholder": {
          "description": "Image file that can be shown instead of the
video or audio file.",
          "$ref": "#/definitions/mediaID"
        },
        "creator": {
          "description": "The id(s) of the creator(s) of the media
file",
          "oneOf": [
            {

```

```

        "$ref": "#/definitions/personID"
    },
    {
        "type": "array",
        "items": {
            "$ref": "#/definitions/personID"
        }
    }
]
},
"contributor": {
    "description": "The id(s) of the contributor(s) of the media
file",
    "oneOf": [
        {
            "$ref": "#/definitions/personID"
        },
        {
            "type": "array",
            "items": {
                "$ref": "#/definitions/personID"
            }
        }
    ]
},
"publisher": {
    "description": "The id(s) of the publishing institutions of
the media file.",
    "oneOf": [
        {
            "$ref": "#/definitions/organizationID"
        },
        {
            "type": "array",
            "items": {
                "$ref": "#/definitions/organizationID"
            }
        }
    ]
},
"license": {
    "description": "The url to the license under which the media
file falls.",
    "$ref": "#/definitions/url",
    "examples": [
        "https://creativecommons.org/licenses/by/4.0/"
    ]
},
"additionalProperties": false
},
"mediaElement": {

```

```

        "description": "A media element (collection of various formats of
the same media object).",
        "type": "object",
        "properties": {
            "file": {
                "description": "The various formats of the same media
object.",
                "oneOf": [
                    {
                        "$ref": "#/definitions/mediaFile"
                    },
                    {
                        "type": "array",
                        "items": {
                            "$ref": "#/definitions/mediaFile"
                        }
                    }
                ]
            }
        },
        "additionalProperties": false
    },
    "multiPolygon": {
        "description": "The coordinates array of a GeoJSON
MultiPolygon.",
        "type": "array",
        "items": {
            "type": "array",
            "items": {
                "type": "array",
                "items": {
                    "type": "array",
                    "items": {
                        "type": "number"
                    }
                }
            }
        }
    },
    "geography": {
        "description": "A geographic element (name, polygon, and/or
external service).",
        "type": "object",
        "properties": {
            "name": {
                "description": "The name of the area(s).",
                "comment": "Accepts array for multilingual support.",
                "$ref": "#/definitions/localizedString",
                "examples": [
                    "Norway",
                    "Europe",
                    "Trøndelag",

```

```

        [
            "Norge",
            "Norway"
        ]
    },
    "polygon": {
        "description": "The geographical area(s), represented as the
coordinates array of a GeoJSON MultiPolygon.",
        "$ref": "#/definitions/multiPolygon"
    },
    "service": {
        "description": "An url or external service that returns
geographical information.",
        "$ref": "#/definitions/url"
    },
    "additionalProperties": false
},
"externalResource": {
    "description": "A resource managed elsewhere.",
    "type": "object",
    "properties": {
        "serviceId": {
            "description": "The id to one of the externalServices
defined.",
            "$ref": "#/definitions/serviceID"
        },
        "externalId": {
            "description": "The id of the resource at the
externalService.",
            "type": "string"
        }
    },
    "additionalProperties": false
},
"externalService": {
    "description": "Service used by the key, for media files, taxonomy
and/or nomenclature, species distributions, etc.",
    "type": "object",
    "required": [
        "id"
    ],
    "properties": {
        "id": {
            "description": "Internally unique id to the service.",
            "$ref": "#/definitions/serviceID"
        },
        "title": {
            "description": "Name of the service.",
            "type": "string"
        }
    },

```

```

        "description": {
            "description": "Description of the service.",
            "type": "string"
        },
        "provider": {
            "description": "Provider of the service.",
            "type": "string"
        },
        "url": {
            "description": "Url for the service documentation.",
            "$ref": "#/definitions/url"
        }
    },
    "additionalProperties": false
},
"person": {
    "type": "object",
    "required": [
        "id",
        "name"
    ],
    "properties": {
        "id": {
            "$ref": "#/definitions/personID"
        },
        "name": {
            "description": "Full name of the person",
            "comment": "Accepts object for multilingual support.",
            "$ref": "#/definitions/LocalizedString"
        },
        "email": {
            "description": "Email address of the person",
            "type": "string",
            "format": "email"
        },
        "url": {
            "description": "Hyperlink to more information on the person
(valid url).",
            "comment": "Accepts object for multilingual support.",
            "$ref": "#/definitions/localizedUrl"
        },
        "media": {
            "description": "A media file (image) representing the
person.",
            "$ref": "#/definitions/mediaID"
        },
        "affiliation": {
            "description": "Organization id(s) the person is affiliated
with.",
            "oneOf": [
                {
                    "$ref": "#/definitions/organizationID"
                }
            ]
        }
    }
}

```

```

        },
        {
            "type": "array",
            "items": {
                "$ref": "#/definitions/organizationID"
            }
        }
    ]
}
},
"additionalProperties": false
},
"organization": {
    "type": "object",
    "required": [
        "id",
        "name"
    ],
    "properties": {
        "id": {
            "$ref": "#/definitions/organizationID"
        },
        "name": {
            "description": "Name of the organization",
            "comment": "Accepts object for multilingual support.",
            "$ref": "#/definitions/localizedString"
        },
        "url": {
            "description": "Hyperlink to more information on the
organization (valid url).",
            "comment": "Accepts object for multilingual support.",
            "$ref": "#/definitions/localizedUrl"
        },
        "primaryContact": {
            "description": "The person-id that is the main contact point
for the organization.",
            "$ref": "#/definitions/personID"
        },
        "media": {
            "description": "A media file (image) representing the
organization, such as a logo.",
            "$ref": "#/definitions/mediaID"
        }
    },
    "additionalProperties": false
},
"userRequirement": {
    "type": "object",
    "required": [
        "id"
    ],
    "properties": {

```

```

    "id": {
      "$ref": "#/definitions/userRequirementID"
    },
    "title": {
      "comment": "Accepts array for multilingual support.",
      "$ref": "#/definitions/localizedString"
    },
    "warning": {
      "comment": "Accepts array for multilingual support.",
      "$ref": "#/definitions/localizedString"
    },
    "description": {
      "description": "Short description of the requirements to the
user (valid markdown).",
      "comment": "Accepts object for multilingual support.",
      "$ref": "#/definitions/localizedString",
      "contentMediaType": "text/markdown"
    },
    "descriptionDetails": {
      "description": "Extended description of the requirements to
the user that supplements the description (valid markdown).",
      "comment": "Accepts object for multilingual support.",
      "$ref": "#/definitions/localizedString",
      "contentMediaType": "text/markdown"
    },
    "descriptionUrl": {
      "description": "Hyperlink to more information on the
requirements to the user (valid url).",
      "comment": "Accepts object for multilingual support.",
      "$ref": "#/definitions/localizedUrl"
    },
    "media": {
      "description": "Media or illustration that informs the user on
the requirements to the user.",
      "comment": "Accepts object for multilingual support.",
      "$ref": "#/definitions/mediaID"
    }
  },
  "additionalProperties": false
},
"taxon": {
  "type": "object",
  "oneOf": [
    {
      "required": [
        "id",
        "scientificName"
      ]
    }
  ],
  {
    "required": [
      "id",

```

```

        "externalReference"
    ]
},
{
    "required": [
        "id",
        "label"
    ]
}
],
"properties": {
    "id": {
        "description": "Internally unique id to the taxon.",
        "$ref": "#/definitions/taxonID"
    },
    "scientificName": {
        "description": "Scientific name of the taxon.",
        "minLength": 5,
        "type": "string",
        "examples": [
            "Vulpes lagopus"
        ]
    },
    "scientificNameAuthor": {
        "description": "Author string of the scientific name of the
taxon.",
        "type": "string",
        "examples": [
            "Koch, 1888"
        ]
    },
    "placeholderName": {
        "description": "Name that can be shown while fetching the name
externally. Also useful for editing the key.",
        "comment": "Accepts object for multilingual support.",
        "$ref": "#/definitions/localizedString",
        "examples": [
            "B. hortorum (melanistic queen)"
        ]
    },
    "vernacularName": {
        "description": "Vernacular name of the taxon.",
        "comment": "Accepts object for multilingual support.",
        "$ref": "#/definitions/localizedString",
        "examples": [
            "fjellrev",
            {
                "no": "fjellrev",
                "en": "Arctic Fox"
            }
        ]
    }
}
],
},

```



```

"media": {
  "description": "Media elements of the taxon.",
  "oneOf": [
    {
      "$ref": "#/definitions/mediaID"
    },
    {
      "type": "array",
      "items": {
        "$ref": "#/definitions/mediaID"
      }
    }
  ]
},
"description": {
  "description": "Short description of the taxon (valid
markdown).",
  "comment": "Accepts object for multilingual support.",
  "$ref": "#/definitions/localizedString",
  "contentMediaType": "text/markdown"
},
"descriptionDetails": {
  "description": "Extended description of the taxon that
supplements the description (valid markdown).",
  "comment": "Accepts object for multilingual support.",
  "$ref": "#/definitions/localizedString",
  "contentMediaType": "text/markdown"
},
"descriptionUrl": {
  "description": "Hyperlink or resource to more information on
the taxon.",
  "comment": "Accepts object for multilingual support.",
  "$ref": "#/definitions/localizedUrl"
},
"rank": {
  "description": "Name of the level of the taxon.",
  "comment": "Accepts object for multilingual support.",
  "$ref": "#/definitions/localizedString",
  "examples": [
    "slekt",
    {
      "no": "slekt",
      "en": "genus"
    }
  ]
},
"label": {
  "description": "Type of morph of the taxon.",
  "type": "string",
  "minLength": 0,
  "examples": [
    "male",

```

```

        "♀",
        "larva"
    ],
    },
    "isEndPoint": {
        "description": "Whether the key should stop when this taxon is
the only remaining possibility, even when it has multiple children
remaining.",
        "comment": "Default is FALSE (if not specified). A taxon
without children is always an endpoint by definition, unless one of its
ancestors overrides this by being specified as an endpoint.",
        "type": "boolean"
    },
    "children": {
        "type": "array",
        "items": {
            "$ref": "#/definitions/taxon"
        }
    },
    "externalReference": {
        "description": "Reference to a taxon at one or more providers,
each as an object with a provider id and a taxon id at that provider.",
        "comment": "Accepts an array for multiple sources. Each
element accepts an object for multilingual support.",
        "oneOf": [
            {
                "$ref": "#/definitions/localizedUrl"
            },
            {
                "type": "array",
                "items": {
                    "$ref": "#/definitions/localizedUrl"
                }
            }
        ]
    },
    "followUp": {
        "description": "Url or reference to instance at external
service for a key for this taxon, that for instance can be used to
identify to a lower rank than the current key can.",
        "comment": "Accepts array for multilingual support.",
        "$ref": "#/definitions/localizedUrl"
    },
    "geography": {
        "description": "The area(s) in which the taxon occurs,
represented as a geography object.",
        "$ref": "#/definitions/geography"
    },
    },
    "additionalProperties": false
},
"character": {

```

```

"type": "object",
"required": [
  "id",
  "title",
  "states"
],
"properties": {
  "id": {
    "description": "Internally unique id to the character.",
    "$ref": "#/definitions/characterID"
  },
  "title": {
    "description": "Name of the character.",
    "comment": "Accepts array for multilingual support.",
    "$ref": "#/definitions/localizedString",
    "examples": [
      "Color of the wings"
    ]
  },
  "media": {
    "description": "The media element(s) of the character. Can be
used to inform user of relevant structures etc.",
    "oneOf": [
      {
        "$ref": "#/definitions/mediaID"
      },
      {
        "type": "array",
        "items": {
          "$ref": "#/definitions/mediaID"
        }
      }
    ]
  },
  "description": {
    "description": "Short description of the character (valid
markdown).",
    "comment": "Accepts object for multilingual support.",
    "$ref": "#/definitions/localizedString",
    "contentMediaType": "text/markdown"
  },
  "descriptionDetails": {
    "description": "Extended description of the character that
supplements the description (valid markdown).",
    "comment": "Accepts object for multilingual support.",
    "$ref": "#/definitions/localizedString",
    "contentMediaType": "text/markdown"
  },
  "descriptionUrl": {
    "description": "Hyperlink or resource to more information on
the character.",
    "comment": "Accepts object for multilingual support.",

```

```

        "$ref": "#/definitions/localizedUrl"
    },
    "type": {
        "description": "Type of the character (exclusive when states
are categorical and mutually exclusive, non-exclusive when these are
non-exclusive, or numerical when the state is numerical).",
        "comment": "Default is exclusive (if not specified).",
        "type": "string",
        "enum": [
            "exclusive",
            "non-exclusive",
            "numerical"
        ]
    },
    "userRequirement": {
        "description": "Id to the userRequirement required to answer
this character.",
        "comment": "Has to be one of the userRequirement defined on
the key level.",
        "$ref": "#/definitions/userRequirementID"
    },
    "logicalPremise": {
        "description": "Logical requirement that has to be fulfilled
for this question to be asked.",
        "comment": "Has to refer to stateIds, that have to be fully
true (either answered or all alternatives ruled out). Can use !, &&, ||,
(, ), <, >, =.",
        "type": "string",
        "pattern": "^(( && )|( \\|\\|
)|( && )|( \\|\\| )|[a-z0-9_:(!<>=)]+$"
    },
    "states": {
        "oneOf": [
            {
                "type": "array",
                "items": {
                    "$ref": "#/definitions/state"
                }
            },
            {
                "$ref": "#/definitions/state"
            }
        ]
    }
},
"additionalProperties": false
},
"state": {
    "description": "The value a character can have.",
    "type": "object",
    "oneOf": [
        {

```

```

        "required": [
            "id",
            "title"
        ]
    },
    {
        "required": [
            "id",
            "min",
            "max",
            "stepSize",
            "unit"
        ]
    }
],
"properties": {
    "id": {
        "description": "Internally unique id of the state.",
        "$ref": "#/definitions/stateID"
    },
    "title": {
        "description": "Content of the state.",
        "comment": "Only to be used for categorical characters.
Accepts object for multilingual support.",
        "$ref": "#/definitions/localizedString"
    },
    "media": {
        "description": "Media element(s) that illustrate the state.",
        "oneOf": [
            {
                "$ref": "#/definitions/mediaID"
            },
            {
                "type": "array",
                "items": {
                    "$ref": "#/definitions/mediaID"
                }
            }
        ]
    },
    "description": {
        "description": "Short description of the state (valid
markdown).",
        "comment": "Accepts object for multilingual support.",
        "$ref": "#/definitions/localizedString",
        "contentMediaType": "text/markdown"
    },
    "descriptionDetails": {
        "description": "Extended description of the state that
supplements the description (valid markdown).",
        "comment": "Accepts object for multilingual support.",
        "$ref": "#/definitions/localizedString",

```

```

        "contentMediaType": "text/markdown"
    },
    "descriptionUrl": {
        "description": "Hyperlink or resource to more information on
the state.",
        "comment": "Accepts object for multilingual support.",
        "$ref": "#/definitions/localizedUrl"
    },
    "min": {
        "description": "Lowest numerical value of the state (over all
taxa).",
        "comment": "Only to be used for numerical characters",
        "type": "number"
    },
    "max": {
        "description": "Highest possible numerical value of the state
(over all taxa).",
        "comment": "Only to be used for numerical characters",
        "type": "number"
    },
    "stepSize": {
        "description": "Step size of the state (steps between min and
max, over all taxa).",
        "comment": "Only to be used for numerical characters",
        "type": "number"
    },
    "unit": {
        "description": "Unit in which the state is measured or
counted.",
        "comment": "Only to be used for numerical characters. Accepts
object for multilingual support.",
        "$ref": "#/definitions/localizedString",
        "examples": [
            "mm",
            "meters below the surface",
            "spots",
            "legs",
            "kg"
        ]
    },
    "additionalProperties": false
},
"statement": {
    "description": "A fact connecting a taxon and a character through
a certain value.",
    "type": "object",
    "required": [
        "id",
        "taxon",
        "character",
        "value",

```

```

    "frequency"
  ],
  "properties": {
    "id": {
      "description": "Internally unique id of the statement.",
      "$ref": "#/definitions/statementID"
    },
    "taxon": {
      "description": "Id of the taxon this statement is about.",
      "$ref": "#/definitions/taxonID"
    },
    "character": {
      "description": "Id of the character this statement is
about.",
      "$ref": "#/definitions/characterID"
    },
    "value": {
      "description": "A value for this character for this taxon.
Must be either the id of a state, or an array of floats [min, max] for a
numerical range.",
      "oneOf": [
        {
          "$ref": "#/definitions/stateID"
        },
        {
          "type": "array",
          "items": {
            "type": "number"
          },
          "minItems": 2,
          "maxItems": 2
        }
      ]
    },
    "frequency": {
      "description": "The frequency with which the taxon has this
value for this character.",
      "type": "number",
      "minimum": 0,
      "maximum": 1
    },
    "geography": {
      "description": "The area(s) in which the taxon can have this
property, represented as a geography object.",
      "$ref": "#/definitions/geography"
    },
    "media": {
      "description": "Illustration(s) of this particular taxon
having this particular property (this value for this character).",
      "oneOf": [
        {
          "$ref": "#/definitions/mediaID"
        }
      ]
    }
  }
}

```

```

    },
    {
      "type": "array",
      "items": {
        "$ref": "#/definitions/mediaID"
      }
    }
  ]
},
"description": {
  "description": "Short description of the taxon having this
property (valid markdown).",
  "comment": "Accepts array for multilingual support.",
  "$ref": "#/definitions/localizedString",
  "contentMediaType": "text/markdown"
},
"descriptionDetails": {
  "description": "Extended description of the taxon having this
property that supplements the description (valid markdown).",
  "comment": "Accepts array for multilingual support.",
  "$ref": "#/definitions/localizedString",
  "contentMediaType": "text/markdown"
},
"descriptionUrl": {
  "description": "Hyperlink or resource to more information on
the taxon having this property.",
  "comment": "Accepts array for multilingual support.",
  "$ref": "#/definitions/localizedUrl"
}
},
"additionalProperties": false
}
}
}

```