

S1 Appendix. Clavis JSON-schema

```
1 {
2   "$schema": "http://json-schema.org/draft-07/schema#",
3   "title": "Clavis identification key schema",
4   "description": "Clavis-compliant keys contain knowledge that may be
5   used to distinguish taxa from each other.",
6   "type": "object",
7   "required": [
8     "$schema",
9     "title",
10    "language",
11    "license",
12    "creator",
13    "lastModified",
14    "identifier",
15    "taxa",
16    "characters",
17    "statements",
18    "persons"
19  ],
20  "properties": {
21    "$schema": {
22      "description": "The schema url of (this) schema defining the
23      format of the key.",
24      "$ref": "#/definitions/url"
25    },
26    "title": {
27      "description": "The name of the key",
28      "comment": "Accepts array for multilingual support.",
29      "$ref": "#/definitions/localizedString",
30      "examples": [
31        "Birds of Norway"
32      ]
33    },
34    "media": {
35      "description": "The logo/illustration image of the key.",
36      "$ref": "#/definitions/mediaID"
37    },
38    "description": {
39      "description": "Short description of the key (valid
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40 markdown).",
41     "comment": "Accepts array for multilingual support.",
42     "$ref": "#/definitions/localizedString",
43     "contentMediaType": "text/markdown"
44 },
45     "descriptionDetails": {
46         "description": "Extended description of the key that supplements
47 the description (valid markdown).",
48         "comment": "Accepts array for multilingual support.",
49         "$ref": "#/definitions/localizedString",
50         "contentMediaType": "text/markdown"
51     },
52     "descriptionUrl": {
53         "description": "Hyperlink to more information on the key (valid
54 url).",
55         "comment": "Accepts array for multilingual support.",
56         "$ref": "#/definitions/localizedUrl"
57     },
58     "audience": {
59         "description": "Description of the intended audience for the
60 key.",
61         "comment": "Accepts array for multilingual support.",
62         "$ref": "#/definitions/localizedString",
63         "examples": [
64             "Undergraduate students and up."
65         ]
66     },
67     "source": {
68         "description": "Source of the key.",
69         "comment": "Accepts array for multilingual support.",
70         "$ref": "#/definitions/localizedString",
71         "examples": [
72             "Koch, Wouter (2019). Birds of Norway. ISBN 1234567890"
73         ]
74     },
75     "sourceUrl": {
76         "description": "Hyperlink to the source of the key (valid
77 url).",
78         "comment": "Accepts array for multilingual support.",
79         "$ref": "#/definitions/localizedUrl",
80         "examples": [
81             "https://doi.org/10.1126/science.1251554"
82         ]
83     },
84     "geography": {
85         "description": "The region for which the key is valid (e.g.

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86 covers all subtaxa), represented as a geography object.",
87     "$ref": "#/definitions/geography"
88 },
89     "primaryContact": {
90         "description": "The organization- or person-id that is the main
91 contact point for the key.",
92         "oneOf": [
93             {
94                 "$ref": "#/definitions/personID"
95             },
96             {
97                 "$ref": "#/definitions/organizationID"
98             }
99         ]
100     },
101     "creator": {
102         "description": "The id(s) of the creator(s) of the key",
103         "oneOf": [
104             {
105                 "$ref": "#/definitions/personID"
106             },
107             {
108                 "type": "array",
109                 "items": {
110                     "$ref": "#/definitions/personID"
111                 }
112             }
113         ]
114     },
115     "contributor": {
116         "description": "The id(s) of the contributor(s) of the key",
117         "oneOf": [
118             {
119                 "$ref": "#/definitions/personID"
120             },
121             {
122                 "type": "array",
123                 "items": {
124                     "$ref": "#/definitions/personID"
125                 }
126             }
127         ]
128     },
129     "publisher": {
130         "description": "The id(s) of the publishing institutions of the
131 key.",

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132     "oneOf": [
133         {
134             "$ref": "#/definitions/organizationID"
135         },
136         {
137             "type": "array",
138             "items": {
139                 "$ref": "#/definitions/organizationID"
140             }
141         }
142     ],
143 },
144 "license": {
145     "description": "The url to the license under which the key
146 falls.",
147     "$ref": "#/definitions/url",
148     "examples": [
149         "https://creativecommons.org/licenses/by/4.0/"
150     ]
151 },
152 "language": {
153     "description": "The ISO 639-1 code(s) of the key language(s).",
154     "comment": "String for a single language, array of strings for
155 multilingual support. If used as an array, be sure to use the
156 localizedString and localizedUrl as arrays too.",
157     "oneOf": [
158         {
159             "type": "string",
160             "pattern": "^[a-z]{2}$"
161         },
162         {
163             "type": "array",
164             "items": {
165                 "type": "string",
166                 "pattern": "^[a-z]{2}$"
167             }
168         }
169     ],
170     "examples": [
171         "en",
172         "nb",
173         [
174             "en",
175             "nb"
176         ]
177     ]

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178     },
179     "created": {
180         "description": "The moment the key was made or first published,
181 as 'YYYY-MM-DD hh:mm:ss'.",
182         "type": "string",
183         "pattern": "~20\d\d-(0[1-9]|1[0-2])-(0[12]\d|3[01])
184 ([01]\d|2[0-3]):([0-5]\d):([0-5]\d)$",
185         "examples": [
186             "2019-05-21 22:51:55"
187         ]
188     },
189     "lastModified": {
190         "description": "The most recent moment the key was modified, as
191 'YYYY-MM-DD hh:mm:ss'.",
192         "type": "string",
193         "pattern": "~20\d\d-(0[1-9]|1[0-2])-(0[12]\d|3[01])
194 ([01]\d|2[0-3]):([0-5]\d):([0-5]\d)$",
195         "examples": [
196             "2019-05-21 22:51:55"
197         ]
198     },
199     "identifier": {
200         "description": "The GUID of this key (persistent regardless of
201 version).",
202         "type": "string"
203     },
204     "url": {
205         "description": "The url of where the key lives (to check for
206 newer versions).",
207         "$ref": "#/definitions/url"
208     },
209     "externalServices": {
210         "description": "Services used by the key for lookups of images,
211 taxa, etc.",
212         "type": "array",
213         "items": {
214             "$ref": "#/definitions/externalService"
215         }
216     },
217     "userRequirements": {
218         "description": "Requirements to the users of the various
219 characters, so that the user can be warned, helped, etc.",
220         "type": "array",
221         "items": {
222             "$ref": "#/definitions/userRequirement"
223         }

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224     },
225     "taxa": {
226         "description": "Taxa (e.g. species) the key can resolve to. Do
227 not have to be exclusively taxonomic units.",
228         "comment": "Taxa to which the key can resolve (either the taxa
229 directly or their children).",
230         "type": "array",
231         "items": {
232             "$ref": "#/definitions/taxon"
233         }
234     },
235     "characters": {
236         "description": "Characters (questions, e.g. 'Wing color' or
237 'Number of spots') used to distinguish between two or more taxa.",
238         "type": "array",
239         "items": {
240             "$ref": "#/definitions/character"
241         }
242     },
243     "statements": {
244         "description": "Relationships between taxa and character states
245 (or lack thereof) that define those taxa.",
246         "type": "array",
247         "items": {
248             "$ref": "#/definitions/statement"
249         }
250     },
251     "persons": {
252         "description": "Persons that are connected to (parts of) the
253 key, such as creators.",
254         "type": "array",
255         "items": {
256             "$ref": "#/definitions/person"
257         }
258     },
259     "organizations": {
260         "description": "Organizations that are connected to (parts of)
261 the key or persons, such as employers and publishers.",
262         "type": "array",
263         "items": {
264             "$ref": "#/definitions/organization"
265         }
266     },
267     "mediaElements": {
268         "description": "Media elements that are used in the key.",
269         "type": "array",

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270         "items": {
271             "$ref": "#/definitions/localizedMediaElement"
272         }
273     },
274 },
275 "additionalProperties": false,
276 "definitions": {
277     "localizedString": {
278         "description": "Language-dependent string or object of strings,
279 with keys corresponding to the languages supported by the key.",
280         "oneOf": [
281             {
282                 "type": "string"
283             },
284             {
285                 "type": "object",
286                 "propertyNames": {
287                     "pattern": "^[a-z]{2}$"
288                 },
289                 "properties": {},
290                 "additionalProperties": {
291                     "type": "string"
292                 }
293             }
294         ]
295     },
296     "localizedUrl": {
297         "description": "Language-dependent urls or object of urls,
298 corresponding to the languages supported by the key.",
299         "oneOf": [
300             {
301                 "$ref": "#/definitions/url"
302             },
303             {
304                 "type": "object",
305                 "propertyNames": {
306                     "pattern": "^[a-z]{2}$"
307                 },
308                 "properties": {},
309                 "additionalProperties": {
310                     "$ref": "#/definitions/url"
311                 }
312             }
313         ]
314     },
315     "localizedMediaElement": {

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316         "type": "object",
317         "description": "Language-dependent media element or object of
318 media elements, corresponding to the languages supported by the
319 key.",
320         "properties": {
321             "id": {
322                 "description": "Internally unique id of the localized media
323 element.",
324                 "$ref": "#/definitions/mediaID"
325             },
326             "mediaElement": {
327                 "description": "The media element or media elements (one for
328 each language).",
329                 "oneOf": [
330                     {
331                         "$ref": "#/definitions/mediaElement"
332                     },
333                     {
334                         "type": "object",
335                         "propertyNames": {
336                             "pattern": "^[a-z]{2}$"
337                         },
338                         "properties": {},
339                         "additionalProperties": {
340                             "$ref": "#/definitions/mediaElement"
341                         }
342                     }
343                 ]
344             },
345             "additionalProperties": false
346         },
347         "url": {
348             "description": "String formed as a url, or an external
349 resource.",
350             "oneOf": [
351                 {
352                     "type": "string",
353                     "format": "uri"
354                 },
355                 {
356                     "$ref": "#/definitions/externalResource"
357                 }
358             ]
359         },
360         "taxonID": {
361

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362         "description": "String used as an internal ID for a taxon.
363 Lowercase alphanumeric and underscores are allowed.",
364         "type": "string",
365         "pattern": "^taxon:[a-z0-9_]+$"
366     },
367     "characterID": {
368         "description": "String used as an internal ID for a character.
369 Lowercase alphanumeric and underscores are allowed.",
370         "type": "string",
371         "pattern": "^character:[a-z0-9_]+$"
372     },
373     "stateID": {
374         "description": "String used as an internal ID for a state.
375 Lowercase alphanumeric and underscores are allowed.",
376         "type": "string",
377         "pattern": "^state:[a-z0-9_]+$"
378     },
379     "personID": {
380         "description": "String used as an internal ID for a person.
381 Lowercase alphanumeric and underscores are allowed.",
382         "type": "string",
383         "pattern": "^person:[a-z0-9_]+$"
384     },
385     "organizationID": {
386         "description": "String used as an internal ID for an
387 organization. Lowercase alphanumeric and underscores are allowed.",
388         "type": "string",
389         "pattern": "^organization:[a-z0-9_]+$"
390     },
391     "serviceID": {
392         "description": "String used as an internal ID for a service.
393 Lowercase alphanumeric and underscores are allowed.",
394         "type": "string",
395         "pattern": "^service:[a-z0-9_]+$"
396     },
397     "statementID": {
398         "description": "String used as an internal ID for a statement.
399 Lowercase alphanumeric and underscores are allowed.",
400         "type": "string",
401         "pattern": "^statement:[a-z0-9_]+$"
402     },
403     "userRequirementID": {
404         "description": "String used as an internal ID for a user
405 requirement. Lowercase alphanumeric and underscores are allowed.",
406         "type": "string",
407         "pattern": "^requirement:[a-z0-9_]+$"

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408     },
409     "mediaID": {
410         "description": "String used as an internal ID for a media
411 element. Lowercase alphanumeric and underscores are allowed.",
412         "type": "string",
413         "pattern": "^media:[a-z0-9_]+$"
414     },
415     "mediaFile": {
416         "type": "object",
417         "properties": {
418             "title": {
419                 "description": "The title of the media file.",
420                 "$ref": "#/definitions/localizedString"
421             },
422             "url": {
423                 "description": "The reference to the media file (url or
424 resource).",
425                 "$ref": "#/definitions/url"
426             },
427             "file": {
428                 "description": "The actual media file (base64 or svg) as a
429 data URI scheme.",
430                 "oneOf": [
431                     {
432                         "type": "string",
433                         "pattern":
434 "^data:([a-z0-9/]+);base64,([a-zA-Z0-9+/=]+$)"
435                     },
436                     {
437                         "type": "string",
438                         "pattern": "^data:image/svg+xml;utf8,(.*)$"
439                     }
440                 ]
441             },
442             "width": {
443                 "description": "The number of pixels horizontally (if a
444 bitmap image or video).",
445                 "type": "integer"
446             },
447             "height": {
448                 "description": "The number of pixels vertically (if a bitmap
449 image or video).",
450                 "type": "integer"
451             },
452             "length": {
453                 "description": "The length in seconds of an audio or video

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454 file.",
455     "type": "integer"
456 },
457     "placeholder": {
458         "description": "Image file that can be shown instead of the
459 video or audio file.",
460         "$ref": "#/definitions/mediaID"
461     },
462     "creator": {
463         "description": "The id(s) of the creator(s) of the media
464 file",
465         "oneOf": [
466             {
467                 "$ref": "#/definitions/personID"
468             },
469             {
470                 "type": "array",
471                 "items": {
472                     "$ref": "#/definitions/personID"
473                 }
474             }
475         ]
476     },
477     "contributor": {
478         "description": "The id(s) of the contributor(s) of the media
479 file",
480         "oneOf": [
481             {
482                 "$ref": "#/definitions/personID"
483             },
484             {
485                 "type": "array",
486                 "items": {
487                     "$ref": "#/definitions/personID"
488                 }
489             }
490         ]
491     },
492     "publisher": {
493         "description": "The id(s) of the publishing institutions of
494 the media file.",
495         "oneOf": [
496             {
497                 "$ref": "#/definitions/organizationID"
498             },
499             {

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500         "type": "array",
501         "items": {
502             "$ref": "#/definitions/organizationID"
503         }
504     },
505 ]
506 },
507 "license": {
508     "description": "The url to the license under which the media
509 file falls.",
510     "$ref": "#/definitions/url",
511     "examples": [
512         "https://creativecommons.org/licenses/by/4.0/"
513     ]
514 },
515 },
516 "additionalProperties": false
517 },
518 "mediaElement": {
519     "description": "A media element (collection of various formats
520 of the same media object).",
521     "type": "object",
522     "properties": {
523         "file": {
524             "description": "The various formats of the same media
525 object.",
526             "oneOf": [
527                 {
528                     "$ref": "#/definitions/mediaFile"
529                 },
530                 {
531                     "type": "array",
532                     "items": {
533                         "$ref": "#/definitions/mediaFile"
534                     }
535                 }
536             ]
537         }
538     },
539     "additionalProperties": false
540 },
541 "multiPolygon": {
542     "description": "The coordinates array of a GeoJSON
543 MultiPolygon.",
544     "type": "array",
545     "items": {

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546         "type": "array",
547         "items": {
548             "type": "array",
549             "items": {
550                 "type": "array",
551                 "items": {
552                     "type": "number"
553                 }
554             }
555         }
556     },
557     "geography": {
558         "description": "A geographic element (name, polygon, and/or
559 external service).",
560         "type": "object",
561         "properties": {
562             "name": {
563                 "description": "The name of the area(s).",
564                 "comment": "Accepts array for multilingual support.",
565                 "$ref": "#/definitions/localizedString",
566                 "examples": [
567                     "Norway",
568                     "Europe",
569                     "Trøndelag",
570                     [
571                         "Norge",
572                         "Norway"
573                     ]
574                 ]
575             },
576             "polygon": {
577                 "description": "The geographical area(s), represented as the
578 coordinates array of a GeoJSON MultiPolygon.",
579                 "$ref": "#/definitions/multiPolygon"
580             },
581             "service": {
582                 "description": "An url or external service that returns
583 geographical information.",
584                 "$ref": "#/definitions/url"
585             }
586         },
587         "additionalProperties": false
588     },
589     "externalResource": {
590         "description": "A resource managed elsewhere.",
591

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```

592         "type": "object",
593         "properties": {
594             "serviceId": {
595                 "description": "The id to one of the externalServices
596 defined.",
597                 "$ref": "#/definitions/serviceID"
598             },
599             "externalId": {
600                 "description": "The id of the resource at the
601 externalService.",
602                 "type": "string"
603             }
604         },
605         "additionalProperties": false
606     },
607     "externalService": {
608         "description": "Service used by the key, for media files,
609 taxonomy and/or nomenclature, species distributions, etc.",
610         "type": "object",
611         "required": [
612             "id"
613         ],
614         "properties": {
615             "id": {
616                 "description": "Internally unique id to the service.",
617                 "$ref": "#/definitions/serviceID"
618             },
619             "title": {
620                 "description": "Name of the service.",
621                 "type": "string"
622             },
623             "description": {
624                 "description": "Description of the service.",
625                 "type": "string"
626             },
627             "provider": {
628                 "description": "Provider of the service.",
629                 "type": "string"
630             },
631             "url": {
632                 "description": "Url for the service documentation.",
633                 "$ref": "#/definitions/url"
634             }
635         },
636         "additionalProperties": false
637     },

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638     "person": {
639         "type": "object",
640         "required": [
641             "id",
642             "name"
643         ],
644         "properties": {
645             "id": {
646                 "$ref": "#/definitions/personID"
647             },
648             "name": {
649                 "description": "Full name of the person",
650                 "comment": "Accepts object for multilingual support.",
651                 "$ref": "#/definitions/localizedString"
652             },
653             "email": {
654                 "description": "Email address of the person",
655                 "type": "string",
656                 "format": "email"
657             },
658             "url": {
659                 "description": "Hyperlink to more information on the person
660 (valid url).",
661                 "comment": "Accepts object for multilingual support.",
662                 "$ref": "#/definitions/localizedUrl"
663             },
664             "media": {
665                 "description": "A media file (image) representing the
666 person.",
667                 "$ref": "#/definitions/mediaID"
668             },
669             "affiliation": {
670                 "description": "Organization id(s) the person is affiliated
671 with.",
672                 "oneOf": [
673                     {
674                         "$ref": "#/definitions/organizationID"
675                     },
676                     {
677                         "type": "array",
678                         "items": {
679                             "$ref": "#/definitions/organizationID"
680                         }
681                     }
682                 ]
683             }

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684     },
685     "additionalProperties": false
686 },
687 "organization": {
688     "type": "object",
689     "required": [
690         "id",
691         "name"
692     ],
693     "properties": {
694         "id": {
695             "$ref": "#/definitions/organizationID"
696         },
697         "name": {
698             "description": "Name of the organization",
699             "comment": "Accepts object for multilingual support.",
700             "$ref": "#/definitions/localizedString"
701         },
702         "url": {
703             "description": "Hyperlink to more information on the
704 organization (valid url).",
705             "comment": "Accepts object for multilingual support.",
706             "$ref": "#/definitions/localizedUrl"
707         },
708         "primaryContact": {
709             "description": "The person-id that is the main contact point
710 for the organization.",
711             "$ref": "#/definitions/personID"
712         },
713         "media": {
714             "description": "A media file (image) representing the
715 organization, such as a logo.",
716             "$ref": "#/definitions/mediaID"
717         }
718     },
719     "additionalProperties": false
720 },
721 "userRequirement": {
722     "type": "object",
723     "required": [
724         "id"
725     ],
726     "properties": {
727         "id": {
728             "$ref": "#/definitions/userRequirementID"
729         },

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730     "title": {
731         "comment": "Accepts array for multilingual support.",
732         "$ref": "#/definitions/localizedString"
733     },
734     "warning": {
735         "comment": "Accepts array for multilingual support.",
736         "$ref": "#/definitions/localizedString"
737     },
738     "description": {
739         "description": "Short description of the requirements to the
740 user (valid markdown).",
741         "comment": "Accepts object for multilingual support.",
742         "$ref": "#/definitions/localizedString",
743         "contentMediaType": "text/markdown"
744     },
745     "descriptionDetails": {
746         "description": "Extended description of the requirements to
747 the user that supplements the description (valid markdown).",
748         "comment": "Accepts object for multilingual support.",
749         "$ref": "#/definitions/localizedString",
750         "contentMediaType": "text/markdown"
751     },
752     "descriptionUrl": {
753         "description": "Hyperlink to more information on the
754 requirements to the user (valid url).",
755         "comment": "Accepts object for multilingual support.",
756         "$ref": "#/definitions/localizedUrl"
757     },
758     "media": {
759         "description": "Media or illustration that informs the user
760 on the requirements to the user.",
761         "comment": "Accepts object for multilingual support.",
762         "$ref": "#/definitions/mediaID"
763     }
764 },
765     "additionalProperties": false
766 },
767     "taxon": {
768         "type": "object",
769         "oneOf": [
770             {
771                 "required": [
772                     "id",
773                     "scientificName"
774                 ]
775             }

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```

776     {
777         "required": [
778             "id",
779             "externalReference"
780         ]
781     },
782     {
783         "required": [
784             "id",
785             "label"
786         ]
787     }
788 ],
789 "properties": {
790     "id": {
791         "description": "Internally unique id to the taxon.",
792         "$ref": "#/definitions/taxonID"
793     },
794     "scientificName": {
795         "description": "Scientific name of the taxon.",
796         "minLength": 5,
797         "type": "string",
798         "examples": [
799             "Vulpes lagopus"
800         ]
801     },
802     "scientificNameAuthor": {
803         "description": "Author string of the scientific name of the
804 taxon.",
805         "type": "string",
806         "examples": [
807             "Koch, 1888"
808         ]
809     },
810     "placeholderName": {
811         "description": "Name that can be shown while fetching the
812 name externally. Also useful for editing the key.",
813         "comment": "Accepts object for multilingual support.",
814         "$ref": "#/definitions/localizedString",
815         "examples": [
816             "B. hortorum (melanistic queen)"
817         ]
818     },
819     "vernacularName": {
820         "description": "Vernacular name of the taxon.",
821         "comment": "Accepts object for multilingual support.",

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822         "$ref": "#/definitions/localizedString",
823         "examples": [
824             "fjellrev",
825             {
826                 "no": "fjellrev",
827                 "en": "Arctic Fox"
828             }
829         ]
830     },
831     "media": {
832         "description": "Media elements of the taxon.",
833         "oneOf": [
834             {
835                 "$ref": "#/definitions/mediaID"
836             },
837             {
838                 "type": "array",
839                 "items": {
840                     "$ref": "#/definitions/mediaID"
841                 }
842             }
843         ]
844     },
845     "description": {
846         "description": "Short description of the taxon (valid
847 markdown).",
848         "comment": "Accepts object for multilingual support.",
849         "$ref": "#/definitions/localizedString",
850         "contentMediaType": "text/markdown"
851     },
852     "descriptionDetails": {
853         "description": "Extended description of the taxon that
854 supplements the description (valid markdown).",
855         "comment": "Accepts object for multilingual support.",
856         "$ref": "#/definitions/localizedString",
857         "contentMediaType": "text/markdown"
858     },
859     "descriptionUrl": {
860         "description": "Hyperlink or resource to more information on
861 the taxon.",
862         "comment": "Accepts object for multilingual support.",
863         "$ref": "#/definitions/localizedUrl"
864     },
865     "rank": {
866         "description": "Name of the level of the taxon.",
867         "comment": "Accepts object for multilingual support.",

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868         "$ref": "#/definitions/localizedString",
869         "examples": [
870             "slekt",
871             {
872                 "no": "slekt",
873                 "en": "genus"
874             }
875         ]
876     },
877     "label": {
878         "description": "Type of morph of the taxon.",
879         "type": "string",
880         "minLength": 0,
881         "examples": [
882             "male",
883             "♀",
884             "larva"
885         ]
886     },
887     "isEndPoint": {
888         "description": "Whether the key should stop when this taxon
889 is the only remaining possibility, even when it has multiple children
890 remaining.",
891         "comment": "Default is FALSE (if not specified). A taxon
892 without children is always an endpoint by definition, unless one of its
893 ancestors overrides this by being specified as an endpoint.",
894         "type": "boolean"
895     },
896     "children": {
897         "type": "array",
898         "items": {
899             "$ref": "#/definitions/taxon"
900         }
901     },
902     "externalReference": {
903         "description": "Reference to a taxon at one or more
904 providers, each as an object with a provider id and a taxon id at that
905 provider.",
906         "comment": "Accepts an array for multiple sources. Each
907 element accepts an object for multilingual support.",
908         "oneOf": [
909             {
910                 "$ref": "#/definitions/localizedUrl"
911             },
912             {
913                 "type": "array",

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914         "items": {
915             "$ref": "#/definitions/localizedUrl"
916         }
917     }
918 ]
919 },
920 "followUp": {
921     "description": "Url or reference to instance at external
922 service for a key for this taxon, that for instance can be used to
923 identify to a lower rank than the current key can.",
924     "comment": "Accepts array for multilingual support.",
925     "$ref": "#/definitions/localizedUrl"
926 },
927 "geography": {
928     "description": "The area(s) in which the taxon occurs,
929 represented as a geography object.",
930     "$ref": "#/definitions/geography"
931 }
932 },
933 "additionalProperties": false
934 },
935 "character": {
936     "type": "object",
937     "oneOf": [
938         {
939             "required": [
940                 "id",
941                 "title",
942                 "states"
943             ]
944         },
945         {
946             "required": [
947                 "id",
948                 "title",
949                 "type",
950                 "min",
951                 "max",
952                 "stepSize",
953                 "unit"
954             ]
955         }
956     ],
957     "properties": {
958         "id": {
959             "description": "Internally unique id to the character.",

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960         "$ref": "#/definitions/characterID"
961     },
962     "title": {
963         "description": "Name of the character.",
964         "comment": "Accepts array for multilingual support.",
965         "$ref": "#/definitions/localizedString",
966         "examples": [
967             "Color of the wings"
968         ]
969     },
970     "media": {
971         "description": "The media element(s) of the character. Can
972 be used to inform user of relevant structures etc.",
973         "oneOf": [
974             {
975                 "$ref": "#/definitions/mediaID"
976             },
977             {
978                 "type": "array",
979                 "items": {
980                     "$ref": "#/definitions/mediaID"
981                 }
982             }
983         ]
984     },
985     "description": {
986         "description": "Short description of the character (valid
987 markdown).",
988         "comment": "Accepts object for multilingual support.",
989         "$ref": "#/definitions/localizedString",
990         "contentMediaType": "text/markdown"
991     },
992     "descriptionDetails": {
993         "description": "Extended description of the character that
994 supplements the description (valid markdown).",
995         "comment": "Accepts object for multilingual support.",
996         "$ref": "#/definitions/localizedString",
997         "contentMediaType": "text/markdown"
998     },
999     "descriptionUrl": {
1000         "description": "Hyperlink or resource to more information on
1001 the character.",
1002         "comment": "Accepts object for multilingual support.",
1003         "$ref": "#/definitions/localizedUrl"
1004     },
1005     "type": {

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1006         "description": "Type of the character (exclusive when states
1007 are categorical and mutually exclusive, non-exclusive when these are
1008 non-exclusive, or numerical when the state is numerical).",
1009         "comment": "Default is exclusive (if not specified).",
1010         "type": "string",
1011         "enum": [
1012             "exclusive",
1013             "non-exclusive",
1014             "numerical"
1015         ]
1016     },
1017     "userRequirement": {
1018         "description": "Id to the userRequirement required to answer
1019 this character.",
1020         "comment": "Has to be one of the userRequirement defined on
1021 the key level.",
1022         "$ref": "#/definitions/userRequirementID"
1023     },
1024     "logicalPremise": {
1025         "description": "Logical requirement that has to be fulfilled
1026 for this question to be asked.",
1027         "comment": "Has to refer to stateIds, that have to be fully
1028 true (either answered or all alternatives ruled out). Can use !, &&,
1029 ||, (, ), <, >, =.",
1030         "type": "string",
1031         "pattern": "^( ( && ) | ( \\| |
1032 ) | ( && ) | ( \\| | ) | [a-z0-9_:( ) !<>=] ) + $"
1033     },
1034     "min": {
1035         "type": "number",
1036         "description": "The minimum numerical value for the
1037 character."
1038     },
1039     "max": {
1040         "type": "number",
1041         "description": "The maximum numerical value for the
1042 character."
1043     },
1044     "stepSize": {
1045         "type": "number",
1046         "description": "The increments with which the numerical
1047 value of the character can be specified."
1048     },
1049     "unit": {
1050         "description": "The unit of the numerical value.",
1051         "$ref": "#/definitions/localizedString",

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1052         "examples": [
1053             "mm",
1054             "meters below the surface",
1055             "spots",
1056             "legs",
1057             "kg"
1058         ]
1059     },
1060     "states": {
1061         "oneOf": [
1062             {
1063                 "type": "array",
1064                 "items": {
1065                     "$ref": "#/definitions/state"
1066                 }
1067             },
1068             {
1069                 "$ref": "#/definitions/state"
1070             }
1071         ]
1072     }
1073 },
1074 "additionalProperties": false
1075 },
1076 "state": {
1077     "description": "The value a character can have.",
1078     "type": "object",
1079     "required": [
1080         "id",
1081         "title"
1082     ],
1083     "properties": {
1084         "id": {
1085             "description": "Internally unique id of the state.",
1086             "$ref": "#/definitions/stateID"
1087         },
1088         "title": {
1089             "description": "Content of the state.",
1090             "comment": "Only to be used for categorical characters.
1091 Accepts object for multilingual support.",
1092             "$ref": "#/definitions/localizedString"
1093         },
1094         "media": {
1095             "description": "Media element(s) that illustrate the
1096 state.",
1097         "oneOf": [

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1098         {
1099             "$ref": "#/definitions/mediaID"
1100         },
1101         {
1102             "type": "array",
1103             "items": {
1104                 "$ref": "#/definitions/mediaID"
1105             }
1106         }
1107     ]
1108 },
1109 "description": {
1110     "description": "Short description of the state (valid
1111 markdown).",
1112     "comment": "Accepts object for multilingual support.",
1113     "$ref": "#/definitions/localizedString",
1114     "contentMediaType": "text/markdown"
1115 },
1116 "descriptionDetails": {
1117     "description": "Extended description of the state that
1118 supplements the description (valid markdown).",
1119     "comment": "Accepts object for multilingual support.",
1120     "$ref": "#/definitions/localizedString",
1121     "contentMediaType": "text/markdown"
1122 },
1123 "descriptionUrl": {
1124     "description": "Hyperlink or resource to more information on
1125 the state.",
1126     "comment": "Accepts object for multilingual support.",
1127     "$ref": "#/definitions/localizedUrl"
1128 }
1129 },
1130 "additionalProperties": false
1131 },
1132 "statement": {
1133     "description": "A fact connecting a taxon and a character
1134 through a certain value.",
1135     "type": "object",
1136     "required": [
1137         "id",
1138         "taxon",
1139         "character",
1140         "value",
1141         "frequency"
1142     ],
1143     "properties": {

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1144         "id": {
1145             "description": "Internally unique id of the statement.",
1146             "$ref": "#/definitions/statementID"
1147         },
1148         "taxon": {
1149             "description": "Id of the taxon this statement is about.",
1150             "$ref": "#/definitions/taxonID"
1151         },
1152         "character": {
1153             "description": "Id of the character this statement is
1154 about.",
1155             "$ref": "#/definitions/characterID"
1156         },
1157         "value": {
1158             "description": "A value for this character for this taxon.
1159 Must be either the id of a state, or an array of floats [min, max] for
1160 a numerical range.",
1161             "oneOf": [
1162                 {
1163                     "$ref": "#/definitions/stateID"
1164                 },
1165                 {
1166                     "type": "array",
1167                     "items": {
1168                         "type": "number"
1169                     },
1170                     "minItems": 2,
1171                     "maxItems": 2
1172                 }
1173             ]
1174         },
1175         "frequency": {
1176             "description": "The frequency with which the taxon has this
1177 value for this character.",
1178             "type": "number",
1179             "minimum": 0,
1180             "maximum": 1
1181         },
1182         "geography": {
1183             "description": "The area(s) in which the taxon can have this
1184 property, represented as a geography object.",
1185             "$ref": "#/definitions/geography"
1186         },
1187         "media": {
1188             "description": "Illustration(s) of this particular taxon
1189 having this particular property (this value for this character).",

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1190         "oneOf": [
1191             {
1192                 "$ref": "#/definitions/mediaID"
1193             },
1194             {
1195                 "type": "array",
1196                 "items": {
1197                     "$ref": "#/definitions/mediaID"
1198                 }
1199             }
1200         ]
1201     },
1202     "description": {
1203         "description": "Short description of the taxon having this
1204 property (valid markdown).",
1205         "comment": "Accepts array for multilingual support.",
1206         "$ref": "#/definitions/localizedString",
1207         "contentMediaType": "text/markdown"
1208     },
1209     "descriptionDetails": {
1210         "description": "Extended description of the taxon having
1211 this property that supplements the description (valid markdown).",
1212         "comment": "Accepts array for multilingual support.",
1213         "$ref": "#/definitions/localizedString",
1214         "contentMediaType": "text/markdown"
1215     },
1216     "descriptionUrl": {
1217         "description": "Hyperlink or resource to more information on
1218 the taxon having this property.",
1219         "comment": "Accepts array for multilingual support.",
1220         "$ref": "#/definitions/localizedUrl"
1221     }
1222 },
1223     "additionalProperties": false
1224 }
1225 }
1226 }

```