Studium Integrale Journal 24 (2017), 4-11 – Zusätzliches Online-Material für

Vogelfedern und Vogelflug
2. Modelle zur Entstehung von Federn

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Dieses PDF-Dokument enthält Anmerkungen mit weiteren Belegen und Originalzitaten

Anmerkungen mit weiteren Belegen und Zitaten

1 „Das Staunenswerte der Schwungfederkonstruktion besteht ja darin, daß sie sich wie eine geschlossene Tragfläche verhält, obwohl sie sehr fein untergliedert ist, wobei die wechselseitigen Verschlußmechanismen der Federteile garantieren, daß eventuelle Einrisse schnell zu reparieren sind und damit die Geschlossenheit der Fläche wieder hergestellt wird“ (Peters 1994, 404). – Zur geringen Luftdurchlässigkeit: Nachtigall (1985, 38).

2 „The complexity of the feather does not stop here, though. The sliding joint made by the hooked and ridged barbules needs lubricating oil. Once the barbs of a feather have been separated, it is difficult for them to come back together. But the owner of the feather has been given a solution to this problem. The bird spends much of its time preening—methodically combing, smoothing, cleaning, and lubricating its feathers. The bird secretes a special preening oil from a gland at the base of its spine. Without this special oil, the birds would be useless in flight“ (http://espanol.apologeticspress.org/articles/2610).

„Birds groom and repair their feathers regularly because it is vital to maintaining efficient aerodynamic surfaces“ (Lingham-Soliar & Murugan 2013, 1).
Vgl. auch http://www.birds-online.de/verhalten/gefiederpflege.htm

3 „Federn müssen ständig gereinigt und gepflegt werden, damit sie in gutem Zustand bleiben. Viele Vögel baden regelmäßig in frischem Wasser, Arten trockener Lebensräume nehmen Sand- oder Staubäder. Häufig – besonders nach dem Baden – pflegt ein Vogel seine Federn, arrangiert sie korrekt und fettet sie mit öligem Sekret aus der Bürzeldrüse nahe der Schwanzbasis ein. Manche Vögel, die keine Bürzeldrüse besitzen, wie Reihe und Papageien, pflegen ihr Gefieder mit speziellen Federn, der Puderdunen, die zu feinem Staub zerfallen, der wie Talk wirkt“ (Kamphuis 2008, 29). „Die meiste Zeit nimmt die Pflege der einzelnen Federn in Anspruch. Sie werden durch den Schnabel gezogen, vorsichtig beknabbert und eventuell mit Sekreten der Bürzeldrüse eingeölt. Dadurch wird die Federstruktur geordnet und wieder hergestellt, anhaftender Schmutz und Parasiten werden entfernt und durch das Öl wird nicht nur das Gefieder wasserdicht, sondern die Einzelfeder wird geschmeidig, bakterizid und fungizid. … Bei der Pflege der Einzelfeder mit dem Schnabel wird die Feinstruktur geordnet“ (Bossert 2000).

4 „The flight feathers of birds must possess among their most important characteristics two almost paradoxical qualities–they must first, be composed of extremely light materials and second, be strong enough to withstand the immense aerodynamic loads experienced during flight (Lingham-Soliar & Murugan 2013, 1).

5 „Feathers must be designed to give the bird lift by causing the air on the top surface to flow faster than the air on the bottom surface (a situation known as the Bernoulli Effect). Flight feathers (often called contour feathers) accomplish lift with the smaller vane on the leading edge in direct contact with the air during flight“ (http://espanol.apologeticspress.org/articles/2610).

6 „A complex pattern of feather muscles connects the calami of neighboring feathers“ (Bock 2000, 479).

7 „Now the curious thing about follicles is that while they produce an enormous variety of feathers, they are extremely conservative. You can look at all follicles for all kinds of feathers, anywhere on the body, in various kinds of birds, and the follicles are virtually identical except in size, and in the case of filoplumes, they do not have muscles“ (Maderson et al. 2000, 705).

8 „feedback mechanism through an intricate nervous network with sensory receptors and motoric innervation.“ Sie schreiben: „For the integument to be able to react appropriately to the ever-changing and unpredictable air currents during flight, a feedback mechanism through an intricate nervous network with sensory receptors and motoric innervation is necessary“ (Homberger & De Silva 2000, 563). Und: „Various experiments (…) suggest that the movements of contour feathers create the stimuli that are received and transmitted by the various receptors and filiform feathers, and collected and processed in the spinal cord and cerebellum“ (Homberger & De Silva 2000, 564).

9 „Feathers are hollow, widely spaced from each other and usually arranged in distinct ‘tracts’, but not long ‘crests’“ (Martin 2008, 46).

10 „Zwei Arten von Muskeln sind für die Bewegung der Federn notwendig. Erstens willkürlich beherrschte Hautmuskeln: Gesichts- und Kehlganghautmuskeln, am Hals und in der Nackengegend der M. sphincter colli und am Rumpfe ausgedehnte Muskelbezirke, die zur Bewegung der Federfluren* dienen. Auch die Spanner der Flughäute, die Spreizmuskeln der Flügelschwingen und die gut entwickelten Aufrichter der Schwanzfedern sind Abkömmlinge der Hautmuskeln“ (Burckhardt et al. 1979, http://link.springer.com/chapter/10.1007/978-3-0348-5304-0_4)

11 Steve Hunter, Feathers: What’s flight got to do - got to do with it? http://ncsce.org/pages/feathers.html

12 „macro-patterning, micro-patterning, intra-bud morphogenesis, follicle morphogenesis and regenerative cycling“.

13 „Molt involves the periodic cessation of growth and disorganization of the follicle collar followed by the subsequent reorganization of the collar and the resumption of growth of a new feather“ (Prum 1999, 301). Weiteres dazu bei Bergman (2003, 34).

14 „… it is currently unclear when feather molt first evolved“ (Prum 1999, 301).

15 „Feathers, however, are hierarchically complex assemblages of numerous evolutionary novelties – the feather follicle, tubular feather germ, feather branched structure, interacting differentiated barbules – that have no homolog in any antecedent structure“ (Prum & Brush 2002, 265). „Since follicles and their accessories are not known in reptilian skin, they are an important innovation associated with feathers“ (Stettenheim 2000, 471).

16 „The feather follicle is the complex organ that provides the spatial organization required to grow feathers. The positioning of the follicle and the control of development within the follicle is determined by a complex cascade of induction and communication between the dermis and epidermis (Sengel, ’76; Wolpert, ’98). With few exceptions, the follicles that produce all the feathers in a bird’s life develop during the first 12 days of life in the egg“ (Prum 1999, 293).

17 „Last, Brush (’99b,c) cites the extraordinary diversity of structures produced by single modern follicles as evidence of the omnipotence of this novel integumental organelle, and he advocates a historically rapid diversification of feathers following the initial origin of the feather follicle“ (Prum 1999, 301). In den Entwicklungsmöglichkeiten eines Federfollikels heutiger Vögel liegt das Potential, die verschiedensten Federtypen hervorzubringen.

18 „Feathers are, therefore, not isolated features in the avian body, but are part of the complex organ, the integument“ (Bock 2000, 479).

19 „Therefore, any scenario that reconstructs the evolutionary history of feathers must deal with the entire integument and its subcutaneous structures“ (Homberger & De Silva 2000, 554).

20 „… the featherbearing avian integument can be subdivided conceptually into three functional components, namely (1) a hydraulic skeleto-muscular apparatus of the feathers, (2) a dermosubcutaneous muscular system of the integument, and (3) a subcutaneous hydraulic skeletal system formed by fat bodies“ (Homberger & De Silva 2000, 556).

21 „Thus, the dermal and subcutaneous muscles, despite being separated by the Fascia superficialis, create an integrated muscular system in which each muscle performs a specific role in ensuring the proper positioning and configuration of feather tracts on the surface of the moving body. This role is necessary for the proper functioning of the hydraulic skeleto-muscular apparatus of the feathers“ (Homberger & De Silva 2000, 560).

22 Vgl. auch Homberger & De Silva (2000, 561): „In conclusion, all cutaneous and subcutaneous structural elements of the featherbearing integument are integral parts of a single coherent biomechanical machinery that is responsible for stabilizing and moving feathers and for integrating them into the overall body construction of a bird. This biomechanical machinery must have evolved in conjunction with the evolutionary development of feathers through modification of structural elements that were already present in the integument of reptilian ancestors of birds.“

23 „...it is not realistic to discuss the evolution of avian feather independently of the evolution of the avian integument with all of its interconnected features“ (Bock 2000, 479).

24 „In addition, it will demonstrate that the evolution of avian feathers has been accompanied by major adjunct innovations in their implantation, coloration, arrangement, operation, growth, and molting“ (Stettenheim 2000, 461).

25 „The sprouting of feathers on the surface of the skin without a machinery to control and regulate their positions is unlikely to have been selectively advantageous for a reptilian organism (cf. Parkes, 1966; but see also Regal, 1975, p. 48). Feathers are also unlikely to have evolved as individual structures and must have evolved as a coat of feathers from their very inception, because their supporting skeleto-muscular apparatus cannot function as isolated units. For the same reasons, feathers could also not have originated in isolated rows of flight feathers along the edges of the forelimbs and tail of reptilian ancestors of birds, as was variously suggested“ (Homberger & De Silva 2000, 561). — Homberger & De Silva (2000) schildern viele Details zum Aufbau der Haut und das Hautuntergewebes bei Vögeln und seine Bedeutung für die Federn und damit fürs Fliegen.

26 „… the transition from forelimb to wing first incorporated the mechanisms for control of lift, thrust, and drag, in response to gravitational forces on the body of the animal“ (Caple et al. 1983, 456).

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